Type 2 Diabetes Self-Management in the Rural Population: A Project Report

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Abstract

Background: The global prevalence of all types of diabetes increased from 108 million in 1980 to 422 million in 2014 (Nazir et al., 2018). The Centers for Disease Control and Prevention (2017) ranks diabetes as the 7th leading cause of death in the United States with an estimated annual expense of $327 billion. Within the rural setting, patients typically have less resources available for the treatment and self-management of their diseases. It is important to explore self-management techniques that can be utilized by patients with type 2 diabetes living in rural areas. Research demonstrating the importance of education, exercise, diet, glucose monitoring, medications, and supportive measures is prominent throughout the literature.

Objective: The purpose of this Doctor of Nursing Practice (DNP) applied project is to investigate the effects of delivering biweekly text messages containing diabetes self-management education (DSME) materials to patients in an effort to support successful self-care.

Methods: During an 8 week period, DSME was provided via text messaging, bi-weekly (Sunday and Wednesday), to 23 rural participants with type 2 diabetes, in a family clinic in Payson, Arizona. Participants were asked to complete the Skills, Confidence, and Preparedness Index both pre- and post- intervention to evaluate their knowledge of diabetes self-management.

Results: Twenty-three adults aged 52 to 78 years (M = 64.91) participated in the project. Of the participants, 57% (13/23) were female. The majority of participants had T2DM diagnosis less than 10 years (M=13.8 years). There was a statistical difference between the pre- and post-Skills, Confidence and Preparedness Index questionnaire ($p < .001$) indicating an improvement in self-efficacy scores post- intervention.

Conclusion: DSME delivered via text message is a cost-effective way to increase patients' self-efficacy and potentially improve their ability to successfully self-manage their disease.

Keywords: type 2 diabetes, rural health, diabetes self-management, text messaging, diabetes education evaluation tool, diabetes educator

Type 2 Diabetes Self-Management in the Rural Population

Chronic conditions are difficult for patients to manage and tend to have a significant impact on patients' quality of life. Diabetes, in particular, is often challenging to manage due to the many nuances involved with diabetes care including medications, lifestyle management, and the underlying potential complications of diabetes to multiple organ systems. The global prevalence of all types of diabetes increased from 108 million in 1980 to 422 million in 2014 (Nazir et al., 2018). The Centers for Disease Control and Prevention (CDC) (2017) ranks diabetes as the 7th leading cause of death in the United States, with an estimated annual expense of $327 billion. In rural America, patients typically have less resources available for disease treatment and self-management when compared to their urban peers. It is therefore important to explore self-management techniques that can be used by patients with type 2 diabetes mellitus (T2DM) living in rural areas. There is robust evidence supporting the importance of education, exercise, appropriate diet, glucose monitoring, medication adherence, and supportive measures for diabetes self-management.

Experiences at a private, Nurse Practitioner owned, rural family practice clinic have demonstrated the need for appropriate interventions specifically for this patient population. A systematic review of the literature demonstrated the prevalence of this issue while helping to support the usefulness of T2DM self-management education in the rural setting.

Problem Statement

Diabetes is costly to treat and manage. The CDC (2018) reports that 30.3 million people have diabetes in the United States, which equates to 9.4% of the population. It is estimated that 7.2 million people remain undiagnosed. Pre-diabetes patients account for 84.1 million adults aged 18 and older. Diabetes was listed as a contributing cause of death in 160,022 death

certificates (Bilton, 2014). Additionally, the incidence of T2DM is expected to continue to increase as the incidence of obesity continues to rise.

In 2011, nearly half of all patients with diabetes had six or more physician office visits, compared to 4% of patients with diabetes that never visited the physician (McEwen & Herman, 2015). Diabetes is the leading cause of major blindness, myocardial infarctions, kidney failure and insufficiency, cerebral vascular accidents, and lower limb amputations (World Health Organization, 2018). In 2017, the cost of diabetes reached an estimated $327 billion, including $90 billion in reduced productivity and $237 billion in direct medical costs. (Peterson, 2018). Diabetes accounts for 1 in 4 health care dollars spent in the U.S.

The American Diabetes Association (2018) reports that 12.5% of the population, or 682,071 people, in Arizona have diabetes. It is estimated that 37.5%, or 1.8 million people, have pre-diabetes. The Arizona Department of Health Services (2018) reports that Arizona's diabetes prevalence rate is above the national average.

Payson, Arizona, located in Gila County, has a rural population of 15,297 with a median age of 57.1 years and a median household income of $45,593 (DataUSA, 2018). Data obtained from the DataUSA website rates the incidence of diabetes in Gila county as 11.2%, which is above the national average. The state diabetes mortality rate is 24.5 per 100,000, compared to Gila county where it is 31.5 per 100,000. Data are based upon 2014 values when citing the economic impact of diabetes in Arizona as $7,887,188,974. There are significant data to support the efficacy of disease self-management education (DSME) in patients with diabetes in Payson and Gila County.

Purpose and Rationale

Diabetes Quality of Life

Patients with diabetes who know the least about their disease stand to gain the greatest benefit from learning disease self-management techniques. Evidence suggests that patients with high disease self-efficacy experience an enhanced quality of life, along with improved health and functionality, through controlling and understanding their disease. Patients who were given educational materials via text messaging to increase awareness while managing their diabetes were able to expand their knowledge of diabetes. This in turn has the potential to reduce hospitalizations, provider office visits, complications, and injuries from diabetes (Ross et al., 2015). When patients manage their diseases effectively, they require less hospital and provider visits, creating a financial gain to the system. Learned self-care behaviors have been shown to normalize blood glucose levels while preventing the development of acute and chronic diabetes complications (Markowitz et al., 2014).

Telehealth

Telehealth is an expanding, innovative means of reaching patients in their homes and almost anywhere imaginable. Examples of telehealth can include remote monitoring of a patient's vital signs, text messaging, video/audio transmissions, communication through the internet, and use of patient portals. Telehealth care allows for broader access to care and the potential for improved quality of life for patients. Telehealth in primary care has consistently been shown to be cost-effective (Dobson et al., 2017). Disparities in the delivery of healthcare, especially for the rural population, can be augmented through effective telehealth availability.

Waller et al., (2019) discuss the benefits of text messaging interventions to improve outcomes of people with T2DM. Their study aimed to evaluate the cost effectiveness of using a text message intervention to provide DSME. Participants received DSME information over a 6-month period in randomized, controlled trial. Primary outcomes measured participants'

glycosylated hemoglobin (HgbA1c) at baseline, as well as at the three and six months marks, post-intervention. Researchers measured secondary outcomes involving behavior change for diabetes self-management, self-efficacy, intervention acceptance and quality of life improvement. These secondary outcomes were evaluated at baseline and at the three and six months marks, post-intervention.

Diabetes Self-Management Education

The quality of DSME substantially depends on the resources available. Patients with T2DM must improve their skills and knowledge to modify their behavior and successfully self-manage their disease and related complications (Burke, Sherr, & Lipman, 2014). Diabetes Educators apply their in-depth knowledge and interpersonal skills to help educate persons with T2DM. Diabetes educators are integral in providing individualized education and promoting behavior change in patients. Unattended, patients must educate themselves, potentially from unreliable sources of information. Or they may be provided with a brief education session while visiting their providers. It is the position of the American Diabetes Association (ADA) that all individuals with diabetes receive Diabetes Self-Management Education and Support (DSME/S) at the time of diagnosis and when subsequently necessary (Powers et al., 2015).

Potential Solution

This Doctor of Nursing Practice (DNP) applied project offered information on the effectiveness of delivering text message based DSME. Implementation offered the opportunity to provide cost-effective, individualized patient care in the rural setting, thus expanding access to DSME. There is a potential to initiate DSME text messaging throughout multiple providers and health systems in Payson, AZ. This resource can be easily disseminated to large numbers of patients with T2DM. The purpose of this DNP applied project was to investigate the effects of

delivering biweekly text messages containing DSME materials to patients of a rural health clinic, in an effort to support successful self-management.

Background and Significance

Patients Diagnosed with Type 2 Diabetes in a Rural Health Setting

Residents of rural communities experience an approximately 17% higher prevalence of T2DM than their urban counterparts (Ross et al., 2015). Additionally, rural patients face an assortment of unique challenges when obtaining health care. Geographical constraints, travel distances, lack of public transportation, the ability to afford healthcare, maldistribution of providers to patient ratios, and lack of Federally funded programs are some of the barriers rural patient face when accessing care of their T2DM (Ross et al., 2015). Rural patients with T2DM rarely have access to an endocrinologist for treatment. Complications related to diabetes are likely to be reduced when a patient's HgbA1c is appropriately controlled and patients are provided DSME (Shahid et al., 2015).

Mallow, Theeke, Barnes, Whetsel, & Mallow (2014) found that rural patients of lower socioeconomic status are at greater risk for impaired disease self-management and are at increased risk for complications. Approximately 62 million Americans live in rural areas with an estimated 20% lacking health insurance. With a lack of primary care providers in many rural areas, there is a significant need to explore and develop innovative means to provide DSME.

The Healthy People 2020 (HP2020) calls for an increase in formal diabetes education by 62.5% (Branch & Lindholm, 2019). Although HP2020 urges the expansion of diabetes education, currently less than 7% of patients with diabetes state they had received formal diabetes education in the year following their diagnosis (Loring et al., 2016).

Bolin et al., (2015) address the challenges of the rural American in their article "Rural Healthy People 2020: New Decade, Same Challenges". Rural Healthy People 2020 (RHP2020) was created as a counterpart to HP2020. RHP2020 is committed to rural health exclusively, with a goal of improving poor health outcomes and health disparities of the rural American by 20%. Diabetes ranked third as one of the most important rural priorities, right behind access to quality health services and nutrition and weight status.

Diabetes Self-Management Education

Siu (2015) discusses the Unites States Preventive Services Task Force Recommendations (USPSTF recommendations) for lifestyle modifications for glycemic control as first-line therapy in the treatment of persons with T2DM. These interventions should include physical activity and diet/nutrition. The USPSTF recommendations recommends screening asymptomatic adults for T2DM in an attempt to provide earlier identification of the disease. The USPSTF stresses that earlier, more intensive treatments, can help prevent the negative health outcomes associated with T2DM. There is, however, the potential to increase the number of newly diagnosed persons with T2DM, thus further limiting access to DSME.

Bin Abbas et. al (2015) discuss the socially popular form of text messaging as a means of communication. A nonrandomized, experimental trial was conducted over a four-month period to determine the effects of mobile phone messaging on glycemic control in 100 patients with T2DM. Twenty educational, multiple-choice questions were used as the pre- and post-intervention assessment survey. Topics of text messaging included signs and symptoms of diabetes, etiology, pathophysiology, psychotherapy, diet and other topics. Messages were sent five to seven times per week, for four months, to each participant. Reminder messages about medications and glucose monitoring were also incorporated. The main educational goal was to

enhance patient knowledge, thus improving practices and attitudes. Findings of this project would suggest that utilizing mobile phone messaging can improve clinical outcomes and diabetes self-management.

Burke, Sherr & Lipman (2014) cite in their peer-reviewed article that one in three Americans either has diabetes or is at risk for developing diabetes. Diabetes self-management is a collaborative effort between the patient, their provider, and ancillary staff. It is a process in which a person with diabetes gains skills and knowledge to help modify their behaviors and effectively manage their disease. Diabetes educators can be a necessary member of the interdisciplinary team to encourage behavior changes and provide individualized education. Without diabetes educators, the need must be filled through other means. With the increasing prevalence of diabetes, there is a growing need to focus on preventative strategies while providing people with the skills and knowledge they can use. Access to diabetes education is profoundly important.

Markowitz et. al (2014) found the text messaging is one of the main forms of communication for younger generations. Researchers state this mode of communication could be a means for implementing mobile health interventions. Goal setting and self-management are two important factors in the management of diabetes. Forty-five participants, aged 16-21, were placed in two randomized groups for one month. The control group received paper based information while the other group received daily text messages. Messages included setting goals, motivational messages, and logistical reminders. Of the participants, 67% stated the text messaging helped to motivate them toward healthier habits and would highly recommend the text messaging program to their friends as compared to 47% of the paper group.

Teleconferencing can be a means to implement education for the patient while overcoming geographical barriers in the rural health setting. Maltinshy et al. (2013) evaluated the success of teleconferencing and diabetes education in rural Scotland. They utilized a semi-structured questionnaire to evaluate the delivery of the education and the enhancement of learning. Feedback from the participants found that the educational content was pertinent. Teleconferencing can provide accessibility to training, cost reduction in care while diminishing other issues that may make access difficult. Based upon the findings of the study, teleconferencing is an easy and effective means to enhance the teaching of the patient living with T2DM.

Dethlefs et al. (2019) used the Chronic Care Model to guide the implementation of their 6-year study. The goal was to improve the quality of health care and outcomes for persons with T2DM (n=1,191) in poor, rural areas of the Dominican Republic. By providing supervision, protocols, medications, behavior therapy, and self-management education materials, researchers found that their participant's HgbA1c met or exceeded expectations within the first three years of the study (Dethlefs et al., 2019). The mean average HgbA1c at the start of the program was 8.8% and was reduced to below 7.0% by year four. These results demonstrate the importance of diabetes self-management and the potential to decrease HgbA1c through appropriate DSME.

Carpenter, Dichiacchio, & Barker (2019) use an integrative review to analyze and critique the interventions used to support diabetes self-management in the patient with T2DM. One-hundred and forty-five studies were included in this inquiry. The researchers consistently found evidence to support the importance of self-management including physical activity, blood glucose monitoring, meal planning, medication management, and appropriate management of blood glucose during illness, hyperglycemia, and hypoglycemia. DSME is best developed when

it can be individualized through the consultation with a variety of health care professionals, providers, advanced practice nurses, registered nurses, dietitians, and pharmacists. Collaboration among healthcare workers is important when educating persons with T2DM on self-management techniques.

Chen, Yu, Li, Zhan, & Yan (2018) performed a qualitative analysis to evaluate the effectiveness of text messaging DSME in rural China. Based on the researchers' findings, patients with T2DM had inadequate knowledge regarding diabetes and decreased adherence to diabetes treatment. Most participants had a positive attitude toward the concept of text messaging DSME with the intention of wanting to improve their knowledge and treatment adherence. The perceived barriers included low educational levels, poor eyesight and gradual loss of interest in the intervention. The frequency, timing, and content of the text messages was considered to aid in the success of the program. Social and family support were also identified as potential necessities for successful implementation.

The benefits of DSME and the various ways in which it can be performed, thus improving access to education, have been well documented. Positive outcomes include controlled HgbA1c, increased physical activity, improved blood glucose monitoring, proper meal planning, medication management, and increased knowledge of managing episodes involving illness and low/high blood glucose levels. This disease can be complicated and difficult to manage. True success to disease management can be achieved with patient education. The disease burden warrants the provider and patient, working in unison, to collaborate and develop an effective plan, which intertwines the threads of multiple educational topics related to diabetes.

Internal Evidence

Practice staff at a rural, nurse practitioner (NP) owned, family health clinic in Payson, Arizona state there is a lack of resources for patients with diabetes in the Payson area. Barriers to effective patient care include limited in-office educational materials and limited access to the only diabetes educator for the Payson area. This lack of available diabetes resources represents a significant limitation to appropriate diabetes care. Diabetes self-management can prove promising in disease control, and yet be challenging to present due to a limitations of resources, especially in the rural setting.

Internal evidence includes the practices' reference to reduced resources within the community where patients can be directed to for learning self-management of their disease. With a significant population of patients with T2DM in the Payson area, the lack of diabetes educators can be harmful to comprehensive diabetes self-management care. This is compounded by minimal DSME support within the office, such as a lack of educational materials and handouts. There is a lack of reliable educational diabetes support for the instruction of exercise, nutrition, medication management or the disease process itself.

Interest in the rural patient with T2DM has led to the examination of patient self-management education gaps. There holds the potential to improve self-management knowledge while effectively managing disease and enhancing quality of life. Access to adequate healthcare can be challenging for the rural patient, thus, education for the self-management of diabetes is imperative.

PICOT Question

This inquiry has led to the clinically relevant PICOT question, “In patients with type 2 diabetes in a rural setting, how does diabetes self-management education (DSME) sent via text messaging, compared to usual care alone, affect diabetes self-management scores?

Search Strategy

An exhaustive search was completed using the following databases: PubMed, CINAHL Plus, and the Cochrane Library. The search strategy used the key terms: *diabetes, rural health, diabetes self-management, text messaging, diabetes educator, and diabetes education evaluation tool*. Due to an abundance of articles related to diabetes, a narrower search strategy was undertaken using more precise terms such as ‘rural health’ and ‘self-management’ to identify studies for inclusion in this review. Inclusion criteria included peer reviewed articles, journals, papers written in English, rural health settings, works that included reported outcomes, adult participants, any country of origin as it pertained to the topic matter, and published works between the years 2014-2019. Exclusion criteria included any articles that pertained to Type 1 Diabetes, simple reviews, editorials, and blogs.

PubMed

PubMed initial search yielded 3,106 articles using the terms *diabetes* AND *self-management* AND *text messaging* AND *diabetes education evaluation tool* OR *diabetes educator*. With further inclusion criteria of “*rural health*” the yield was reduced to 156 articles.

CINAHL Plus

CINAHL Plus initial search yielded 55 articles using the terms *rural health, diabetes, text messaging, diabetes education evaluation tool* AND *self-management*. This search provided substantial, relevant articles and was not revised.

Cochrane Library

Cochrane Library initial search yielded zero reviews and 292 trials using the terms *diabetes, self-management, rural health, text messaging, diabetes education evaluation tool* AND *diabetes educator*. The search inclusion criteria were reduced and adjusted to add "self-management" and "diabetes" to yield 44 reviews.

Critical Appraisal and Synthesis

Melnyk and Fineout-Overholt's (2015) rapid critical appraisal was used to evaluate the ten most pertinent articles. These articles were selected based on their relevance to the posed PICOT question. Evaluation tables were created to organize and outline pertinent information from the ten articles (Appendix A). The critical appraisal of evidence was evaluated for reliability, validity and application in answering the PICOT question. Articles were synthesized upon concepts of interest, levels of evidence, barriers to care and implementation, interventions and outcomes. Thoughtful consideration was given to articles that would be included or excluded based on the predetermined inclusion/exclusion criteria. Studies were organized into analytical attributes to provide a clear reflection of cross study data.

All studies and articles were from a rural health setting (Appendix B). Half of the studies were completed in the United States. The number of subjects per study was greater than 150 in 7 of the studies, thus adding significance to the value of positive outcomes with larger sample sizes.

Study designs varied from qualitative, cross-sectional, pre-post study design, systematic review and randomized control studies. Despite the variation in study designs, a positive outcome pertaining to diabetes self-management with the reduction of HgbA1c levels was achieved in five of the studies that used the measurement of HgbA1c as a primary outcome. The

most commonly used theory was the Social Ecological Theory. The Cognitive Behavioral model was used in several of the remaining articles.

Multiple interventions were used across the studies such as physical activity, diet, glucose monitoring, medication management and T2DM education. These interventions yielded positive findings such as improved knowledge of diabetes while emphasizing the importance of using coordination of care with the patient with T2DM (Appendix B).

Conclusion from Evidence

Throughout the literature, evidence suggests that diabetes self-management can positively impact the quality of life and well-being of the rural patient with T2DM. Rural health providers can effectively empower their patients with T2DM to successfully manage their own disease. Together, the patient and provider must collaborate to manage the patient's disease and improve outcomes. In a rural community setting, it is imperative that resources be available for the persons with T2DM. A self-managed program improves various outcomes related to diabetes. Increased accessibility to educational material is necessary to adopt a successful program for self-management. Positive outcomes were evident in many of the studies that utilized diabetes self-management in addition to the benefits of reduced HgbA1c levels in many of the study subjects. Based on the evidence, the heavy use of technical aids may negatively influence the outcome. The interventions that provided the most positive effect were physical exercise, diet, glucose monitoring and medication management. The Skills, Confidence and Preparedness Index (SCPI) was used during this DNP applied project as a pre- and post- questionnaire to assess the knowledge of self-care management of the patient with T2DM. Increasing the quality of life of the rural patient with T2DM was the desired outcome of this project.

Theory Application

The chronic care model (CCM) is an organized approach to the care of the patient with T2DM in the rural health setting. The CCM (Appendix C) helps to identify the essential elements necessary to implement a diabetes self-management program for improving health outcomes. The challenges that are faced by the rural health setting can be addressed using the CCM through identification of resources within the community.

Mallow et al. (2014) state that the CCM is a strong model for the patient with T2DM in the rural health setting. Their integrative search of articles supports the use of the CCM in this patient population. Using the CCM model, there is the potential to improve rural health care providers' delivery of care and improve access as well as improve the biophysical outcomes of rural patients with T2DM. The underpinning theory, Rosswurm and Larrabee's Model for EBP Change, served as the conceptual foundation for the CCM.

Evidence-Based Project Model

Rosswurm and Larrabee's model for evidence based practice (EBP) change (Appendix D) exemplifies the necessary steps to transformation self-management for the rural patient with T2DM in six relevant phases. The model allows for clear linkage between the problem to interventions and outcomes. Designing a change in practice is easily identified through the Rosswurm and Larrabee model. Diffusion strategies can be used to integrate and maintain changes in practice.

Phase one and two involved the initial assessment and the linkage of the lack of diabetes education to positive interventions to improve disease self-management as essential first steps. Synthesis, phase three, includes identifying types of evidence, reviewing various research concepts, planning and conducting the search of the literature. Phase four, practice change and

design, was developed through identification of the resources necessary to design and implement the change and evaluate the key outcome measures. Implementation and evaluation, phase five, was maintained during the program time frame. Phase six, integration and maintaining practice, will not be achieved during this project time frame, yet can be completed in the future. Medical assistants (MA) in the NP owned clinic can maintain the program by continuing to send text messages to patients who wish to participate in DSME.

Implications for Practice Change

Implications for practice change in the rural setting are beneficial for patients in a multitude of ways. Improvements in the quality of care and quality of life are the greatest benefit for rural patients with T2DM. Patients that better manage their diseases are more productive, happier and require less care from the health care system (Branch and Lindholm, 2019). The cost savings associated with DSME include annual average health care costs reductions of 40% for those that received DSME versus those that had no DSME (Powers, 2016). DSME is low cost to perform when compared to the expense of disease treatment. Additional benefits of DSME include decreased office visits, reduced hospitalizations and reduction in diabetes related complications, which in turn, provides a reduction in health care expenses. Patients with T2DM can successfully manage their disease when provided with the education and proper tools to do so. Research emphasizing the importance of education, exercise, diet, glucose monitoring, and supportive measures has been evident throughout the literature reviewed.

Based upon these findings there was a need to develop a DSME program and implement new practice guidelines for patient education. Key stakeholders include the rural patient with T2DM and the rural health provider. Special consideration was given to participant accessibility to potential forms of delivery of DSME interventions in the rural setting. Based upon the variety

of limitations rural patients may face, text messaging DSME materials was deemed most appropriate for this clinic's population. Participant's knowledge was evaluated through use of the SCPI questionnaire, used to evaluate patients' knowledge of diabetes self-management, both prior to and following the implementation of text messaging.

Methods

Recruitment

Internal Review Board (IRB) approval was received from Arizona State University on 10/1/2019 (Appendix E). This project recruited participants both in a retrospective and prospective manner for a total of three weeks.

Inclusion criteria included: adults 18 years or older; an active patient of the Payson NP owned project site clinic; had attended at least one visit with the clinic in the past year; carried the documented diagnosis of Type 2 diabetes; able to sign his/her own consent; had access to a cell phone capable of receiving text messages; and the ability to read, write, and comprehend English. Exclusion criteria included: patients who carried the documented diagnosis of Type 1 diabetes; unable to sign his/her own consent; active pregnancy; active prisoner status; and inability to read, write, and comprehend English.

Retrospectively, patients meeting inclusion criteria were identified by an electronic record review and contacted via email by the program coordinator during weeks one and two, to assess interest in the program. Information regarding the program was provided via email and/or in person in the Payson NP owned project site clinic. Participants supplied their verbal permission to participate in the DNP applied project.

Prospectively, patients seen in the Payson NP owned project site clinic meeting inclusion criteria were provided information about the program by the Payson NP owned project site clinic

staff or program coordinator. Additionally, posters with the project information and program coordinator contact information were displayed in the clinic waiting area and three exam rooms. Brochures containing project information and program coordinator contact information were given to potential participants interested in the study. The Payson NP owned project site clinic staff additionally keep a list of interested individuals seen throughout the week, secured in a locked desk drawer. The project coordinator contacted these interested individuals by email during the first three weeks of the program. Three attempts were made to contact individuals, after which no additional contact was initiated.

Participants were informed that certain protective measures were in place and were read a verbal consent form. The "script for verbal permission" was used for initiation of email and face-to-face conversations about the DSME project, in addition to consent for project participation. There were no foreseeable physical, psychological, social, or legal risks anticipated with the project. Economic risks potentially included cell phone carrier data service fees for receiving text messages and expense of cell phone usage.

Privacy and Confidentiality

The program coordinator, office staff, provider and ASU DNP mentor had access to the data gathered. The project data collection, pre/post self-assessment studies, and secondary questionnaires were stored in the NP owned clinic office in a locked file cabinet. This data was stored until project completion, April 2020, after which they were securely shredded. All data were protected via training of office staff, password access protection to the clinic and program coordinator's computers and cell phone, physical controls to the Payson NP owned project site clinic office via alarm access to the building, and a locked file cabinet accessed via key only. Names were concealed through the creation of an ID code. The ID code was the first three

letters of the participant's father's name and the last three numbers of their address. Paper "Implied Informed Consents" and "Pre/Postquestionnaire-SCPI tools" were stored in a separate locked file cabinet in the Payson NP owned project site clinic. Electronic data was recorded and stored on the program coordinator's personal password-protected laptop and inputted in Intellectus Statistics software (2020).

Practice Changes

Discussions with the owner of the Payson NP owned clinic, where the project was implemented, has established the potential for continuation of DSME text messaging beyond the completion of the project. The owner has expressed interest in the text messaging DSME project and is pleased with the outcome measures and results. She is interested in continuing the program for other persons with T2DM in her clinic.

Impact

There was a positive correlation with participants' ability to increase their knowledge and understanding of diabetes self-management after receiving DSME. This positive correlation has the potential to reduce participant hospitalizations, provider office visits, as well as complications and injuries from sub-optimally managed diabetes. Additionally, based on the literature, it is reasonable to expect that by improving self-efficacy, participants may also lower HgA1c levels, lower blood glucose levels, increased self-monitoring of blood glucose levels, and improve medication adherence/management. The goals, outcomes and impact chart (Appendix F) identifies the potential project impact on the practice and systems.

Design

Text Messages

One-way, biweekly text messages were sent to participants during an eight-week period. Text messages were designed and correlated with the SCPI tool, and the information found within the questionnaire. All text messages, sixteen in total, were vetted by a Certified Diabetes Educator, John Hancock. Information was arranged in a fashion to establish a foundational understanding of T2DM, complications associated with T2DM, diet, exercise, medications and the "ABCs" (HgbA1c, blood pressure and cholesterol) of T2DM (Appendix G). Text messages included imbedded internet links that lead to additional information on nutrition, the American Diabetes Association (2019), medications, and glucose reference logs. Text messages were kept non-repetitive and innovative with the content of the messages changing from text to text. Texts were also designed to be inspirational and motivational.

Project Description and Timeline

All participants began the program on the same start day, Sunday, November 4, 2019, following the three-week recruitment period. Prior to receiving DSME text messaging, participants were asked to complete the SCPI tool, either on paper, in the Payson NP owned project site clinic office, or via email – based upon patient preference. Participants received two text messages per week (Sundays and Wednesdays) for eight weeks, containing succinct, pertinent, and actionable DSME information. Individual text messages were sent to participants from the program coordinator's cell phone to maintain anonymity of participant's phone numbers. Each participant received 16 text messages total with one final message about the project completion party. Text messages concluded on Wednesday, December 25, 2019. Participants were asked again to complete the "Postquestionnaire-SCPI tool" via their preferred method or at the project completion party open to all participants that was held at the Payson NP owned project site clinic office on January 10, 2020.

Budgets and Funding

Budgets Justification: This budget is the expenses for establishing, maintaining and supporting the DNP applied EBP project (Appendix H).

Funding: Provider at the Payson NP owned project site clinic donated the MA's time invested in the project, along with paper, pens, use of computer(s), office space and use of file cabinets. Program coordinator provided funding for text messaging rates, posters and handouts that were printed in color. Total preparation expenses $628.

Operations: Materials and Supplies; Intellectus Statistical software (2020) was necessary to run the data analysis. The latest version was available at a reduced cost to graduate students. Paper and print for each participant- informative brochures and posters about the project, consent forms (2-4 pages each for each subject), pre/post evaluation tools, and secondary evaluation tools. Writing pens for participants to fill out evaluation forms in the office. Total operations expenses $162.

Technology expenses: Data messaging expense for sending 1-2 text messages, to each participant, over the 3 month project time frame (total of 17 messages for each participant). Total technology expenses $20.

Personnel expenses: Included MA and office assistant's time used for preparation, delivery and evaluation of project, enrolling and assisting participants. In addition to the program coordinator's time used in design, set up of files, preparation, delivery, data entry, validate data entry, evaluation, review and run data analysis of project, enrolling and assisting participants, designing and sending text messages. Additional project time included reviewing the project progress and data with program coordinator's ASU mentor. Total personal expenses $2,442.

The total budget for preparation, delivery and evaluation of this text message DSME project was $2627. Cost reduction is anticipated with subsequent implementations of additional text messaging projects due to the initial set up and design of the project will be minimal post first implementation.

Instruments

Aronson et al. (2017) worked in unison to develop the SCPI tool. The SCPI tool (Appendix I) uses a mixed-method design which was developed based upon the content of the American Association of Diabetes Educators seven (AADE7) self-care behaviors. The tool is divided into three key subscales: skills, confidence and preparedness of diabetes self-management behaviors. Researchers found the tool had excellent internal consistency and is favorable to other similar assessment tools. Readability of the SCPI tool was assessed using the Flesch-Kincaid Readability test. The readability was consistent with an eighth or ninth grade reading level. The tool has a total of 25 questions which can be read easily and self-administered in approximately ten minutes with minimal support from provider or staff.

Researchers found the tool has an excellent internal consistency and is favorable for reliability and validity. The Cronbach's alpha score was used to assess the internal consistency for each of the subscales and the overall scores. There was strong internal consistency with Cronbach's alpha scores ranging from 0.81 to 0.95. Categorical variables were evaluated using the Analysis of Variance (ANOVA). Continuous variables and test-retest reliability was performed using the Spearman's non-parametric correlation ($P < .001$) which showed a high degree of validity. Approval for use of the SCPI was received via email correspondence from Dr. Aronson on August 27, 2019.

Intellectus Statistical software (2020) was used for computation of statistical data and analysis of all project data. Intellectus software was implemented and provided by Arizona State University as a necessary component for statistical analysis.

Data Analysis

Data was coded and anonymized and then kept in a locked file cabinet in the Payson NP owned project site clinic. Pre- and post- SCPI scores were tallied with the minimum score possible of 25 to a maximum score of 250. Each subscale was then computed for pre and post SCPI scores. The "Skills" subscales corresponded to SCPI questions 1, 2, 4, 5, 7, 8, 10, 12 and 22. The "Confidence" subscale corresponded to SCPI questions 3, 6, 11, 14, 16, 18, 19 and 21. The "Preparedness" subscales corresponded to SCPI questions 9, 13, 15, 17, 20, 23, 24 and 25.

Analysis of participant's age, gender and years with T2DM were also computed and graphed. These data were collected on the prequestionnaire, SCPI tool.

Data Results/Outcomes

Participant Demographics

Twenty-three adults aged 52 to 78 years (M = 64.91, SD = 6.96) participated; 56.52% (13/23) were female shown in Table 1. The median years with T2DM was M = 13.78 years (SD = 14.52) shown in Table 2 and Figure 1.

Table 1.

Frequency Table for Nominal Variables

Variable	*n*	*%*
Sex		
F	13	56.52
M	10	43.48
Missing	0	0

Note. Due to rounding errors, percentages may not equal 100%.

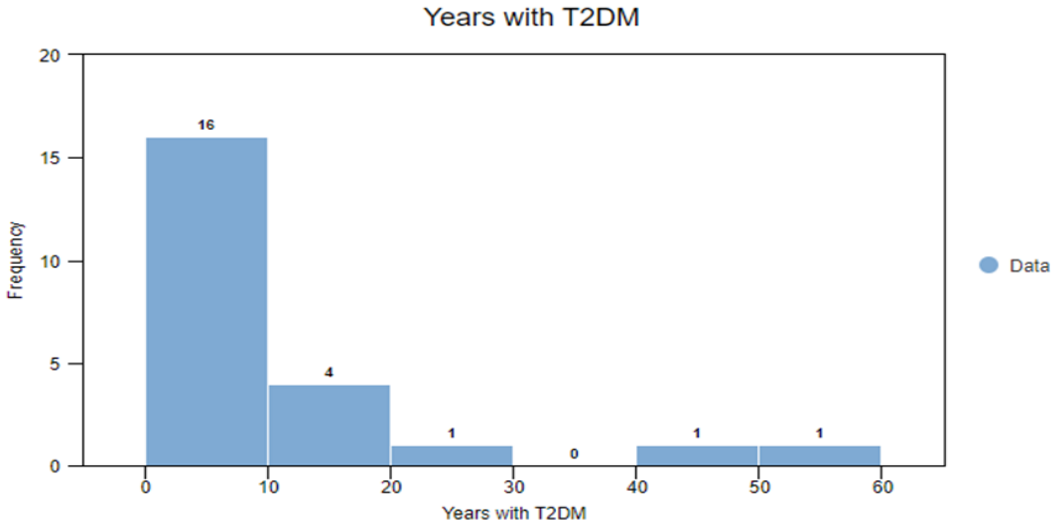
Table 2.

Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	SE_M	Min	Max	Skewness	Kurtosis
Age	64.91	6.96	23	1.45	52.00	78.00	0.17	-0.46
Years_with_T2DM	13.78	14.52	23	3.03	2.00	60.00	2.15	3.85

Note. '-' denotes the sample size is too small to calculate statistic.

Figure 1. Histogram Years with T2DM



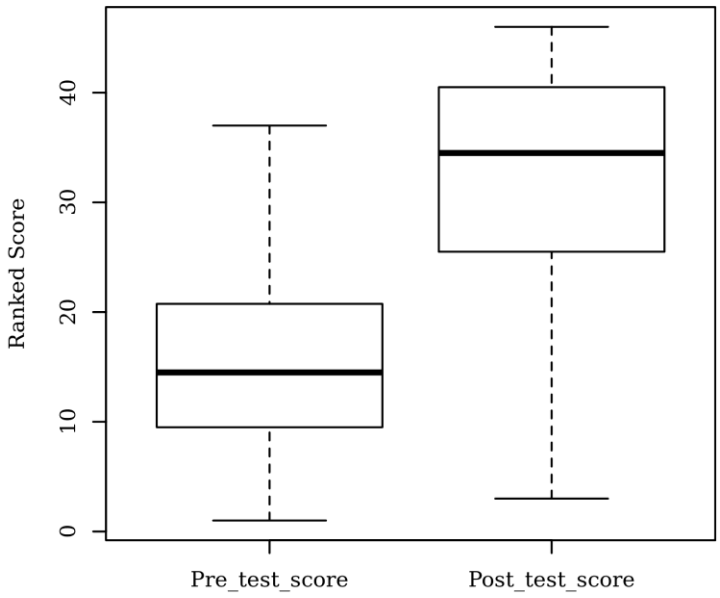
Pre and Post Test Scores

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between Pretest score and Posttest score. The Wilcoxon was used in as the non-parametric alternative to the paired t-test due to the sample size since normal distribution could not be assumed. The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 1.00, z = -4.17, p < .001. This indicates that the differences between Pretest_ core and Posttest score are not likely due to random variation. The median of Pretest score (Mdn = 129.00) was significantly lower than the median of Posttest score (Mdn = 208.00). Figure 3 presents a boxplot of the ranked values of Pretest score and Posttest score. There is a significant deviation difference in pre- and post- intervention SCPI scores suggesting

the intervention reflected an improvement in patient's' diabetes self-management skills, confidence, preparedness scores.

Figure 3

Ranked values of Pretest score and Posttest score



Pre Test Score by Gender

An ANOVA was conducted to determine whether there were significant differences in Pretest score by Gender. The ANOVA was examined based on an alpha value of 0.05. The results of the ANOVA were not significant, $F(1, 21) = 0.01$, $p = .909$, indicating the differences in Pretest score among the levels of Gender were all similar (Table 4). The main effect, Gender was not significant, $F(1, 21) = 0.01$, $p = .909$, indicating there were no significant differences of Pretest score by Gender levels. The means and standard deviations are presented in Table 4. A boxplot for pretest gender scores is presented in Figure 4.

Table 4.

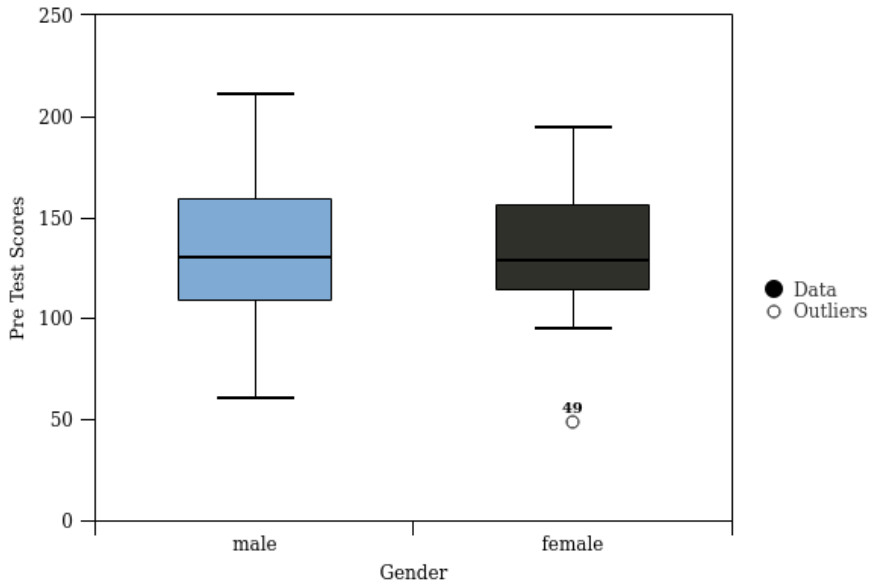
Mean, Standard Deviation, and Sample Size for Pretest score by Gender

Combination	*M*	*SD*	*n*
male	132.10	39.80	10
female	134.08	40.91	13

Note. A '-' indicates the sample size was too small for the statistic to be calculated.

Figure 4.

Pretest score by Gender



Post Test Score by Gender

An ANOVA was conducted to determine whether there were significant differences in Posttest score by Gender. The ANOVA was examined based on an alpha value of 0.05. The results of the ANOVA were not significant, F(1, 21) = 0.14, p = .717, indicating the differences in Posttest score among the levels of Gender were all similar (Table 5). The main effect, Gender was not significant, F(1, 21) = 0.14, p = .717, indicating there were no significant differences of

Posttest score by Gender levels. The means and standard deviations are presented in Table 5. A boxplot for pretest gender scores is presented in Figure 5.

Table 5.

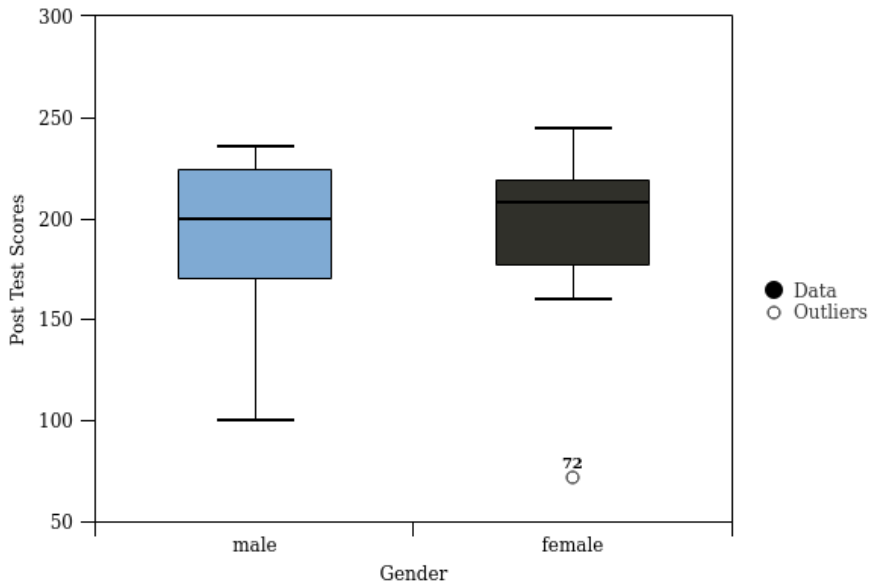
Mean, Standard Deviation, and Sample Size for Post test score by Gender

Combination	*M*	*SD*	*n*
male	186.50	47.68	10
female	193.54	43.84	13

Note. A '-' indicates the sample size was too small for the statistic to be calculated.

Figure 5.

Post test score by Gender



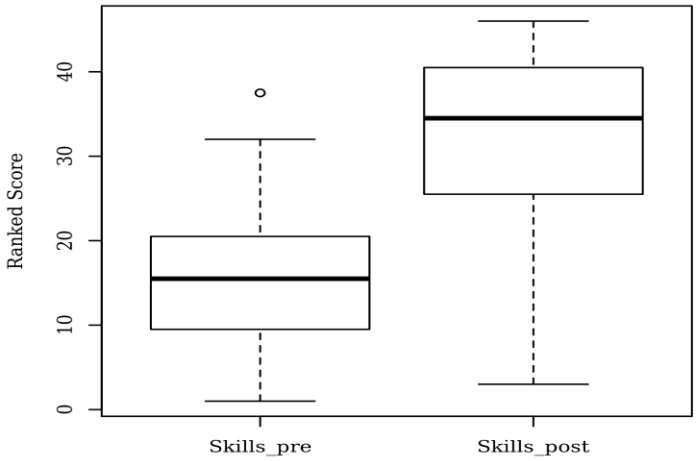
Skills Subscale

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between Skills pre and Skills post. The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 0.00, z = -4.20, p < .001. This indicates that the differences between Skills pre and Skills post are not likely due to random variation. The median of Skills pre (Mdn = 43.00) was significantly lower than the median of

Skills post (Mdn = 76.00). Figure 6 presents a boxplot of the ranked values of Skills pre and Skills post.

Figure 6.

Ranked values of Skills pre and Skills post

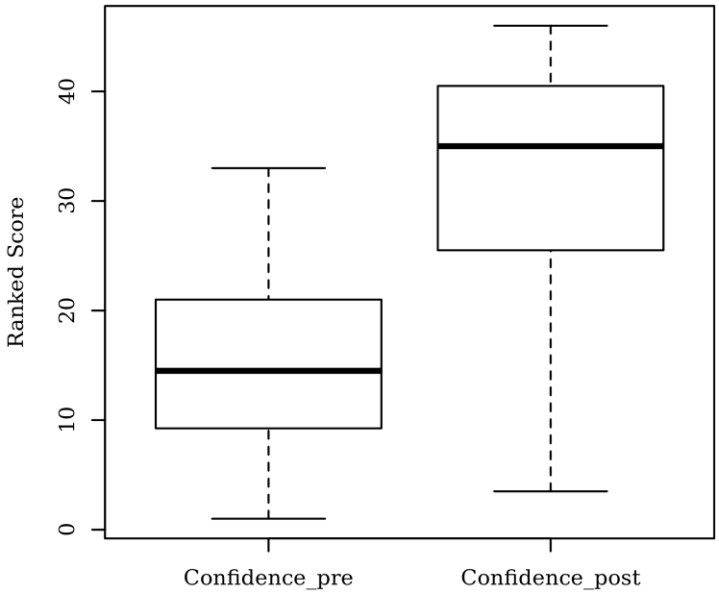


Confidence Subscale

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between Confidence pre and Confidence post. The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 4.50, z = -4.06, $p < .001$. This indicates that the differences between Confidence pre and Confidence post are not likely due to random variation. The median of Confidence pre (Mdn = 45.00) was significantly lower than the median of Confidence post (Mdn = 69.00). Figure 7 presents a boxplot of the ranked values of Confidence pre and Confidence post.

Figure 7.

Ranked values of Confidence pre and Confidence post

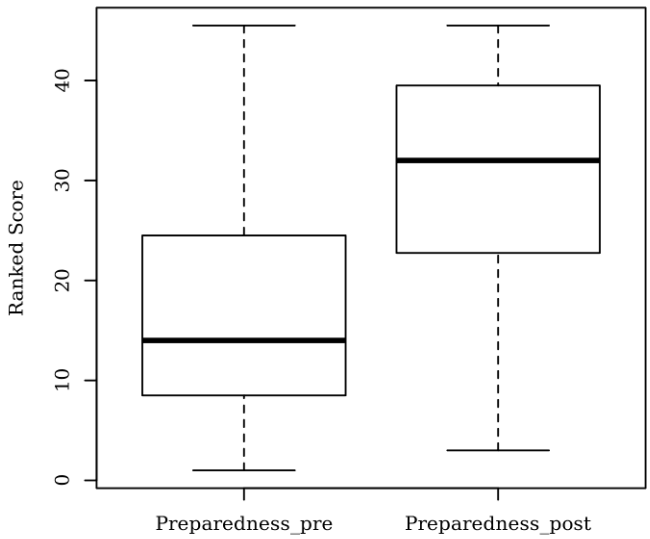


Preparedness Subscale

A two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between Preparedness pre and Preparedness post. The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of 0.05, V = 9.50, z = -3.80, p < .001. This indicates that the differences between Preparedness pre and Preparedness post are not likely due to random variation. The median of Preparedness pre (Mdn = 42.00) was significantly lower than the median of Preparedness post (Mdn = 61.00). Figure 8 presents a boxplot of the ranked values of Preparedness pre and Preparedness post.

Figure 8.

Ranked values of Preparedness pre and Preparedness post



Limitations

ANOVA and linear regression testing could not be performed on pretest and posttest scores against age and years with T2DM due to the following variables having categories with insufficient observations to conduct the analysis. Each group for age and years with T2DM needed at least 3 complete cases to conduct an analysis, which was not possible due to the smaller participant sample size.

Some unanticipated barriers were experienced during program implementation. Technological barriers limited the intended texting platform that was to be initially used. A third party company was paid for anonymous group text messaging. The day of implementation it was found that the texts were limited to 200 characters. This was not disclosed prior to initiating and purchasing the texting system. Accommodations were made, with submission for modification to ASU IRB, to allow the program coordinator's locked, password-protected phone

to be used to send individual text messages to participants. Intermittent challenges of reaching all the participants were addressed as they arose. One participant had to have their messages broken into several smaller messages to ensure the entire message was received due to limitations of her phone.

One participant's text messages failed to send after project week five. The participant failed to notify the program coordinator of their change in phone number or status. They were excluded from the project and computed data due to failure to complete the project.

Implications

Implications for practice in the rural health setting are beneficial in numerous ways. DSME is a low cost intervention as compared to the expense incurred with treating a persons with diabetes. The delivery of DSME has been associated with improved quality of care, improved quality of life, decreased diabetes related complications, reduced hospitalizations, reduction in office visits and a reduction in health care cost by approx. 40% (Powers, 2016). Patients with T2DM can successfully manage their disease when they are provided with the education and proper tools to do so.

The ease of implementation and management of text messaging DSME intervention via text messaging is a positive attribute to providing care. Text messaging can be seen as a means for providing interactive, personalized care. Telehealth is an innovative means of reaching patients. The use of text messaging broadens access to care and increases quality of life for the patients it serves. Disparities in the delivery of DSME, especially for the rural population, can be augmented through the use of telehealth text messaging.

DSME is a billable service under Medicare and most insurance carriers. Patients should receive the allotted hours per year of education to ensure their DSME needs are met. The

importance of disease education cannot be reiterated enough. Research has proven the effectiveness of DSME on HgbA1c levels, post education evaluations, and improvement in the overall health and quality of life for the patients it serves.

Recommendations

Continued use of text-message based DSME in the rural setting for patient education is an appropriate recommendation. DSME delivered via text message is a cost-effective way to increase patients' self-efficacy and potentially improve their ability to successfully self-manage their disease. Text messaging educational information can also be utilized for various other chronic diseases while maintaining a cost-effective, individualized plan of care.

Conclusion

Research demonstrates the importance of education, exercise, diet, glucose monitoring, medications and supportive measures for patients with T2DM. This DNP applied project offered results on the effectiveness of delivering text message based support to the rural patient as an effective means as a tool for delivering diabetes self-management education. There was a statistical difference between the pre- and post- SCPI questionnaires ($p < .001$) indicating an improvement in self-efficacy scores post intervention. The deviation difference in pre- and post-intervention SCPI scores is reflective of the DSME intervention. DSME delivered via text message is a cost-effective way to increase patients' self-efficacy and potentially improve their ability to successfully self-manage their disease.

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Appendix A

Table 1

Evaluation Table

Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement /Instrument	Data Analysis	Findings/Results	Level/Quality of Evidence; Decision for practice/application
Ross, S. et al, (2015). Issues that impact type-2 diabetes self-management in rural communities **Funding:** Authors received no financial support for the research, authorship, &/or publication of this article. **Bias:** None recognized **Country:** USA	Prochaska and DiClemente'sStages of Change Model	**Design:** SR **Purpose:** successful type-2 diabetes support health- care providers to improve disease management and preventative care while delivering the best disease management to assist with self-management of diabetes in rural populations	**N:** 1800 **n:** 22 **DS:** CINAHL via EBSCOhost, PubMed, Ovid, CDC, NRHA, SORH, RHRC **Inclusion Criteria:** barriers to DM2 SM, PT & EDU, GL & recommendations for DM2 **Exclusion Criteria**: lack of factors pertaining to DM2 and RH	**IV1:** barriers to DM2 SM **IV2**: PT & EDU **IV3**: , GL & recommendations for DM2	Instruments not specified. .	JHNEBP	**IV1**: Moderate quality evidence. Seven articles discuss barriers to DM2 SM **IV2:** Moderate quality evidence. 10 articles provide support for benefits of provider directed EDU for DM pts **IV3:** Moderate quality of evidence. Five articles provide guideline suggestions for DM2 SM	**LOE:** I **Strengths:** Thorough discussion of numerous intervention studies that focused on techniques to improve DM2 SM. **Weaknesses:** Limited information, only suggestive, not in depth **Conclusions:** Barriers to DM2 SM provided, EDU techniques to imp. SM were vast and useful **Feasibility/Applicability to pt. population:** Discussed barriers to RH DM2 pt and provided SM suggestions

Key: AAFPF- American Academy of Family Physicians Foundation; **BMI-** Body Mass Index; **CDC-** Centers for Disease Control; **CG** – control group; **CPM-** Communication-Persuasion Model; **DM2**-Diabetes Mellites type 2; **DQ** – descriptive qualitative; **DS –** databases searched; **DSMES-**Diabetes Self-Management Education and Support; **DV**-dependent variable; **EDU**-education; **EMR**- Electronic Medical Record; **FDGs**- Focus Group Discussions; **FG**- focus group; **GL**-Guidelines; **HRSA-**Health Resources & Services Administration; **IG**- intervention group; **IV**- independent variable; **JHNEBP-**John Hopkins Nursing Evidence-Based Practice; **MA-** meta-analyses; **MANOVA**- multivariate analysis of variance; **MD** – mean difference; **mn**- months; **MOA**- Medical Office Assistant; **MTM-** Medication Therapy Management; number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NRCT** – Non-randomized control trials; **NRHA**-National Rural Health Association; **OU**- Ohio University; **PHP**- Public Health Physicians; **pts**- patients; **RCT** – randomized control trial; **RH**- rural health; **RHRC**- Rural Health Research & Policy Centers; **SD –** standard deviation; **SG** – support groups; **SM**-Self Management; **SORH-** State Offices of Rural Health; **SR-** systematic review; **TI**- telephone interviews; **TM**- text message-based; **VD**-Village Doctors; **wk**- weeks; **y.o.** – years-old

Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement /Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Shahid et al., (2015). Mobile phone intervention to improve diabetes care in rural areas of Pakistan: a randomized controlled trial. **Funding:** Authors received no financial support for the research, authorship, &/or publication of this article. **Bias:** None recognized **Country:** Pakistan	Inferred theory of Cognitive-Behavioral Model	**Design:** RCT (pre- & posttest, q15 days for 4-months) **Purpose:** Examine effectiveness of physician mobile phone communication with DM2 pts in RH Pakistan on HgbA1c levels	**N: 440** **n1:** 220 (IG) **n2**: 220 (CG) **Setting**: Dept of endocrinology, Liquat National Hospital, Karachi **Sample Demographics:** No significant differences between CG & IC. Mean age: 48.95 (IG), 49.21 (CG). Female gender: 38.6% (IG), 38.6% (CG). Male gender: 61.4% (IG), 61.4% (CG). **Inclusion Criteria:** 18-70 y.o., live in rural Pakistan, willing to participate, DM2 >3 months, HgbA1c >8.0 **Attrition:** Not discussed	**IV:** reduction in HgbA1c levels **DV1:** physical activity **DV2:** medication intake **DV3:** diet **DV4:** SM blood glucose	HgbA1c	*t*-test, independent t-test, multiple COX regression, Fisher's exact	CG had signif improv to HgbA1c levels (p=0.001). Compared to IG (p=0.522)	**LOE:** II **Strengths:** RCT design, signif decrease in HgbA1c **Weaknesses:** length of study 4 months. Diff to change parameters in such a short amt of time, one setting **Conclusions:** provider communication directly improved pt compliance and ability to SM DM2 **Feasibility/Applicability to pt. population:** This study provides excellent information to the benefits of pt communication and follow up. It helped enhance SM of DM2 and shows great potential as an affordable means of pt EDU

Key: AAFPF- American Academy of Family Physicians Foundation; **BMI-** Body Mass Index; **CDC-** Centers for Disease Control; **CG** – control group; **CPM-** Communication-Persuasion Model; **DM2**-Diabetes Mellites type 2; **DQ** – descriptive qualitative; **DS –** databases searched; **DSMES-**Diabetes Self-Management Education and Support; **DV**-dependent variable; **EDU**-education; **EMR**- Electronic Medical Record; **FDGs**- Focus Group Discussions; **FG**- focus group; **GL**-Guidelines; **HRSA-**Health Resources & Services Administration; **IG**- intervention group; **IV**- independent variable; **JHNEBP-**John Hopkins Nursing Evidence-Based Practice; **MA-** meta-analyses; **MANOVA**- multivariate analysis of variance; **MD** – mean difference; **mn**- months; **MOA**- Medical Office Assistant; **MTM-** Medication Therapy Management; number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NRCT** – Non-randomized control trials; **NRHA**-National Rural Health Association; **OU**- Ohio University; **PHP**- Public Health Physicians; **pts**- patients; **RCT** – randomized control trial; **RH**- rural health; **RHRC**- Rural Health Research & Policy Centers; **SD –** standard deviation; **SG** – support groups; **SM**-Self Management; **SORH-** State Offices of Rural Health; **SR-** systematic review; **TI**- telephone interviews; **TM**- text message-based; **VD**-Village Doctors; **wk**- weeks; **y.o.** – years-old

Citation	Theory/ Conceptual Framework	Design/ Method	Sample/Setting	Major Variables & Definitions	Measurement/ Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Chen et al., (2018). Text message-based intervention to improve treatment adherence among rural patients with type 2 diabetes mellitus: a qualitative study. **Funding:** Fundamental Research Funds for the Central Univ by the Ministry of EDU and finance of China **Bias:** None recognized. **Country:** China	Health Belief Model and CPM	**Design:** Qualitative **Purpose:** Explore the perspective of RH DM2 pats receiving TM for increasing pt adherence.	**N:** 169 **nVD: 24** **nPHP**: 19 **nDM2**: 26 **Setting**: 6 FGDs in Xianning City during 2015 **Sample Demographics:** PHPs, VDs, and DM2 **Inclusion Criteria**: DM@ >18 y.o., DM2 medications, familiar w/TM, VDs and PHPs who FU w/pts >2 yrs, **Exclusion Criteria:** mental disorders, no informed consent, no cell phone	**IV:** PE booster **DV:** IC psychological distress **PE booster:** 90-minute individual booster session with a healthcare provider 6 mns & 2 wks after initial PE intervention. Reviewed initial content & discussed changes in IC circumstances.	**V1**: knowledge about DM2 **V2**; Treatment adherence **V3**: attitudes toward TM supplement to DM2 treatment	Grounded Theory & NVIVO 8 computer software to manage and code all data	TM is a feasible means to benefit DM2 pts in the management of their disease, can improve adherence in rural areas of China	**LOE:** VI **Strengths:** DM2 seemed interested in TM for assistance with DM. Can provide detailed info on status of treatment and adherence **Weaknesses:** Barriers to implementing TM; low edu, poor eye sight, loss of interest **Conclusions:** Results demonstrate a significantly moderate level of significance. Means of TM communication with pt easy and affordable. **Feasibility/Applicability to pt. population:** Accessible to all DM2 pts that have a cellphone and PHP or VD interaction

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Citation	Theory/ Conceptual Framework	Design/ Method	Sample/Setting	Major Variables & Definitions	Measurement/ Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Beverly et al., (2018). A qualitative process evaluation of a diabetes navigation program embedded in an endocrine specialty center in rural Appalachian Ohio. **Funding:** HRSA grant, OU Heritage College of Osteopathic Medicine & Diabetes Institute **Bias:** None recognized **Country:** USA	Harold P. Freeman's Patient Navigation Model	**Design:** Qualitative Study **Purpose:** Assess the fidelity of implementing the Diabetes Navigation Program in rural Appalachian Ohio	**N: 17** **n1:** 5 providers **n2**: 4 health admin. **N3:** 3 Office staff **n4:** 5 Navigators **Setting**: Diabetes Endocrine Center in rural Appalachian Ohio **Sample Demo:** age=44.7±11.6 yrs, 82.4% female, 94.1% white, 13.3±19.6 yrs work exp. **Inclusion Criteria:** providers, staff, etc at the Diabetes Endocrine Center **Attrition:** None	**IV:** Identification of health disparities **IV2:** Navigators the eyes in the community and pt homes **IV3:** Identify diff. w/cross system integration of services	**V1:** Interview guide questions **V2:** Experienced qualitative researcher conducted interviews **V3:** Reflective Journal	Coded transcripts entered Nvivo 11 software	Participants felt the Diabetes Navigation Program was beneficial and necessary	**LOE:** VI **Strengths:** Peer evaluation of the importance of care coordination of the pt with diabetes **Weaknesses:** homogeneity of the study sample re: setting, sample size, ethnicity, self-reported data **Conclusions:** Identification of barriers to care for rural people of Appalachia and challenges for providers **Feasibility/Applicability to pt. population:** This study provides excellent information to the benefits of pt/provider communication and follow up.

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Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement/ Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Jones et al., (2014). Barriers and facilitators to effective type 2 diabetes management in a rural context: a qualitative study with patients with diabetes and health professionals. **Funding:** Authors received no financial support for the research, authorship, &/or publication of this article. **Bias:** None recognized **Country:** Australia	Socio-ecological Framework	**Design:** Qualitative Study **Purpose:** Identify factors that facilitate and prevent effective DM2 management in the rural patient	**N:** 18 DM2 pts **n1:** 8 FG **n2**: 10 TI **Setting**: **Sample Demographics:** n1 age (M=66.9, SD= 5.9) n2 age (M=60.4, SD=15.7) **Inclusion Criteria:** Type 2 patients with diabetes who live in rural Australia **Attrition:** Not discussed	**IV:** Barriers to effective DM2 management in rural contexts **DV1:** intrapersonal **DV2:** interpersonal **DV3:** organizational **DV4:** societal influences	**V1:** telephone interviews **V2:** focus group discussions	inductive thematic analysis framework proposed by Braun and Clarke-description of themes	Identification of 13 themes of barriers and facilitators to DM2 management	**LOE:** VI **Strengths:** Aligned with a previous US study. Emphasize the need for collaborative and interdisciplinary services in rural care for DM2 pts **Weaknesses:** conducted in drought affected area. Recruitment of individuals with DM2 was difficult. **Conclusions:** Need for increase focus on prevention of DM2 and associated complications **Feasibility/Applicability to pt. population:** Identification of barriers to care of the DM2 pt in rural Australia, need to retain health professionals in rural areas

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Citation	Theory/ Conceptual Framework	Design/ Method	Sample/Setting	Major Variables & Definitions	Measurement/ Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Freeman et al., (2018). Patient Engagement in Type 2 Diabetes: A Collaborative Community Health Initiative. **Funding:** Katie B. Reynolds Charitable Trust **Bias:** None recognized **Country:** USA	Social ecological model	**Design:** Pre-post study design over 1 year **Purpose:** Describe the effects of innovative rural community based DSMES	**N:** 152 **n:**115 **Setting**: YMCA of Western North Carolina **Sample Demographics:** Male 39 (33.9%), Female 62 (53.9%), Not reported 14 (12.2%) Age M=57 (SD=9) BMI M=37 (SD=8) HgbA1c M=8.5 (SD=1.8) **Inclusion Criteria:** DM2 adults >18 y.o., can read and understand English, willingness to participate for 1 yr **Attrition:** 31.3% **(**36 participants did not complete the 1 year program)	**IV:** reduction in HgbA1c levels **DV1:** physical activity **DV2:** healthy eating **DV3:** medical management	HgbA1c BMI	SPSS 18.0 software and SAS v9.4, descriptive statistics, paired t tests	Overall signif improv to HgbA1c levels (p=0.001) [95% CI: -2.5, -1.7] t= -10.4	**LOE:** IV **Strengths:** significant decrease in HgbA1c and BMI of participants, proves benefit and cost containment of DSMES programs **Weaknesses:** Some data sets incomplete, lack of resources to search for missing data, study limited to 12 months, high attrition rate **Conclusions:** positive impact on HgbA1 and BMI over 1 yr with community based, healthy behavior DSMES program in the rural setting **Feasibility/Applicability to pt. population:** This study provides excellent information to the benefits of DSMES

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Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement/Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
MacKay et al., (2014). The modified medical office assistant role in rural diabetes care. **Funding:** Authors received support from the Clinician Scholar Program of the UBC Department of Family Practice and by ImpactBC **Bias:** None recognized **Country:** Canada	Inferred theory of Cognitive-Behavioral Model	**Design:** Systematic Review and Qualitative surveys **Purpose:** To determine if expansion of the MOA role in rural practice can be beneficial to DM patients	**N: 187** **n1:** 76 (IG) **n2**: 111 (CG) **Setting**: Physician office in Creston, BC **Sample Demographics:** Significant differences between CG & IC. Mean age: 65 (±12 yr) (t test p=0.6). Female gender: 70% (IG), 38% (CG) (p= 0.002) Male gender: 30% (IG), 62% (CG). **Inclusion Criteria:** DM pts identified via EMR that were notified and willing to participate **Attrition:** 4.81% **(**9 exclusions/deaths)	**IV:** HgbA1c levels **DV1:** Hgb A1c levels **DV2:** MAO appointments w/pts **DV3:** diet **DV4:** SM blood glucose	HgbA1c	2 sample t-test, Mann-Whitney rank test	moderate improv to HgbA1c levels (p=0.1). Compared to IG (M=2.72 SD=1.21) t= 19.59 and CG (M=2.32 SD=1.17) t= 20.882	**LOE:** V **Strengths:** MOAs imp the freq of measurements for DM guidelines, positive outcomes, low attrition rate **Weaknesses:** one office had variability in care, did not measure MOAs cost savings, missed data collection with some pts **Conclusions:** MOA involvement increased pt and provider satisfaction & increased adherence to DM guidelines **Feasibility/Applicability to pt. population:** This study provides excellent information to the benefits of pt communication and follow up with the MOA. Shows great potential as an affordable means of pt EDU and guideline adherence

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Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement/Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Soto et al., (2015). An Ecological Perspective on Diabetes Self-care Support, Self-management Behaviors, and Hemoglobin A1C Among Latinos. **Funding:** Funding from the Peers for Progress network and the AAFPF **Bias:** None recognized **Country:** USA	Social ecological model	**Design:** RCT, cross sectional study **Purpose:** Examine the role of organizational, self and interpersonal support for diabetes self- management behaviors and their effect on HgbA1c	**N: 336** **n:317** **Setting**: Imperial County, California **Sample Demographics:** Mean age: 57 (±12) Female gender: 64% Male gender: 36%, married 61%, foreign-born 79%, employed 24%, less than high school edu 70% **Inclusion Criteria:** Latinos with DM1 or 2, >18 yrs old, A1c >7.0%seen in clinic within the last 3 mo. **Attrition:** Not discussed	**IV:** HgbA1c **DV1:** physical activity **DV2:** glucose monitoring **DV3:** diet **DV4:** foot exams **DV5:** medication adherence	HgbA1c	Multi-variate linear and logistic regression models, SAS version 9.2	HgbA1c SD= 8.53% Self-support signif associated with lower HgbA1c (β=-0.16, p=0.01) coefficient between self-support and HgbA1c was -1.17 indicating that for every 1 unit increase in self-support HgbA1c decreases by 17%	**LOE:** II **Strengths:** Higher self-support is associated with better HgbA1c levels with Latino pts **Weaknesses:** Only 3 sources of support were explored in this study **Conclusions:** Results indicated levels of higher self-support were related to more freq veg/fruit intake, less fat intake and physical activity on most days **Feasibility/Applicability to pt. population:** Study supports the self-management benefits for the DM2 pt and provides examples of sources that help reduce HgbA1c levels

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Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement/Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Johnson et al., (2018). Evaluation of an Academic-Community Partnership to Implement MTM Services in Rural Communities to Improve Pharmaceutical Care for Patients with Diabetes and/or Hypertension. **Funding:** Authors received financial support for from the CDC and Arizona Department of Health Services **Bias:** None recognized **Country:** USA	Inferred theory of Cognitive-Behavioral Model	**Design:** Pilot program with pre-post design **Purpose:** To assess telephone and community based clinical pharmacy services for improving health indicators for underserved rural pts	**N: 552 n:517** **n1:** 220 (IG) **n2**: 220 (CG) **Setting**: 5 rural clinics in AZ **Sample Demographics:** female n=335 (64.8%), Male n=182 (35.2%), age M=65-74, White 363 (70.2%) **Inclusion Criteria:** received care at one of the community partner sites, >18 yrs, current dx HTN and/or DM, living in rural AZ, willing to participate for 1 yr **Attrition:** Not discussed	**IV:** HgbA1c **DV1:** physical activity **DV2:** medication intake **DV3:** diet **DV4:** SM blood glucose	Fasting blood gluc and SBP	Chi-square analysis, paired *t*-test, McNemar's test, Yates correction, Turkey's honestly sig diff test	Fasting blood gluc reduced from 136 to 116 ($p=0.002$) $t= 33.694$ SBP reduced from 155 to 147 ($p<0.001$) $t= 33.856$ Chi results not available in article	**LOE:** II **Strengths:** Large participant number, positive results, pt acceptance of MTM high (93.6%), positive results in all 5 rural clinics **Weaknesses:** n=225 participants had missing data, difference in population demographics, # of participants recruited @ ea. Site **Conclusions:** Evidence to support the efficacy of collaboration efforts of MTM services that improv health indicators while reducing health care disparities **Feasibility/Applicability to pt. population:** This study provides excellent information to the benefits of MTM in the rural health setting to improve pt outcomes in health indicators

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Citation	Theory/ Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement /Instrument	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/application
Aljin et al., (2018). Awareness of diabetes among patients with type 2 diabetes mellitus attending a rural health and training center **Funding:** Authors did not receive financial support **Bias:** None recognized **Country:** India	Chronic Care Model inferred	**Design:** Cross sectional study **Purpose:** Assess the awareness and knowledge about diabetes among patients with type 2 diabetes mellitus in a rural health care center	**N: 258** **Setting**: 2 rural clinics in India **Sample Demographics:** female n=148 (57.3%), Male n=110 (42.6%), age M=53, 95% on PO hypoglycemic meds **Inclusion Criteria:** pts with Type 2 DM, received care at one of the outpatient departments at a rural health and training center, willing to answer 10 question survey **Attrition:** Not discussed	**IV:** T2DM questionnaire **DV:** awareness of T2DM risk factors, role of exercise, complications	10 question structured questionnaire	data entry and analysis SPSS version 16	63.17% of patients had adequate knowledge regarding T2DM	**LOE:** III **Strengths:** Done in a rural health setting with little previous assessments done **Weaknesses:** Small study size not representative of entire T2DM rural population **Conclusions:** Need for improvements to health education on diabetes for patient awareness to improve good lifestyle practices and reduction of burden **Feasibility/Applicability to pt. population:** This study provides support to the benefits of patient education and improvements to disease knowledge and self-management thus improving health outcomes and reducing T2DM burden of costs

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Appendix B

Table 2

Synthesis Table

Author	Aljin	Beverly	Chen	Freeman	Johnson	Jones	MacKay	Ross	Shahid	Soto
Year	2018	2018	2018	2018	2018	2014	2014	2015	2015	2015
Design	CSS	Qual	Qual	PPSD	PPSD	Qual	SR/Qual	SR	RCT	RCT
LOE	III	VI	VI	IV	II	VI	I/VI	I	II	II
Number of subjects	258	17	169	152	552	18	187	22 articles	440	336
Theory	CCM	PNM	HBM/CPM	SEM	CBM	SEM	CBM	SCM	CBM	SEM
Demographics										
Male DM pt	110		8	39	182	10	56		270	
Female DM pt	148		18	62	335	8	131		170	215
Providers		5	43							
Office Staff		3								
Health Admin.		4								
Articles								22		

CBM- Cognitive Behavioral Model; **CC**- Coordination of care; **CCM**- Chronic Care Model; **CPM**- Communication-Persuasion Model; **CSS**- Cross Sectional Study; **DM**- Diabetes Mellitus; **HBM**- Health Belief Model; **PNM**- Patient Navigation Model; **PPSD**- Pre and post study design; **SCM**- Stages of Change Model; **SEM**- Social Ecological Model; **SM**- Self-management; **SR**- Systematic review; **Qual-** Qualitative studies

Setting										
Rural Setting/Population	X	X	X	X	X	X	X	X	X	X
United States		X		X	X			X		X
India	X									
China			X							
Australia						X				
Canada							X			
Pakistan									X	
Interventions										
Physical Activity	X			X	X				X	X
Diet				X	X		X		X	X
Glucose monitoring				X	X		X	X	X	X
Medication management				X	X		X		X	X
T2DM education	X	X	X	X	X	X	X	X	X	X
Reflective Journaling		X								
Technological Aids			X			X				X

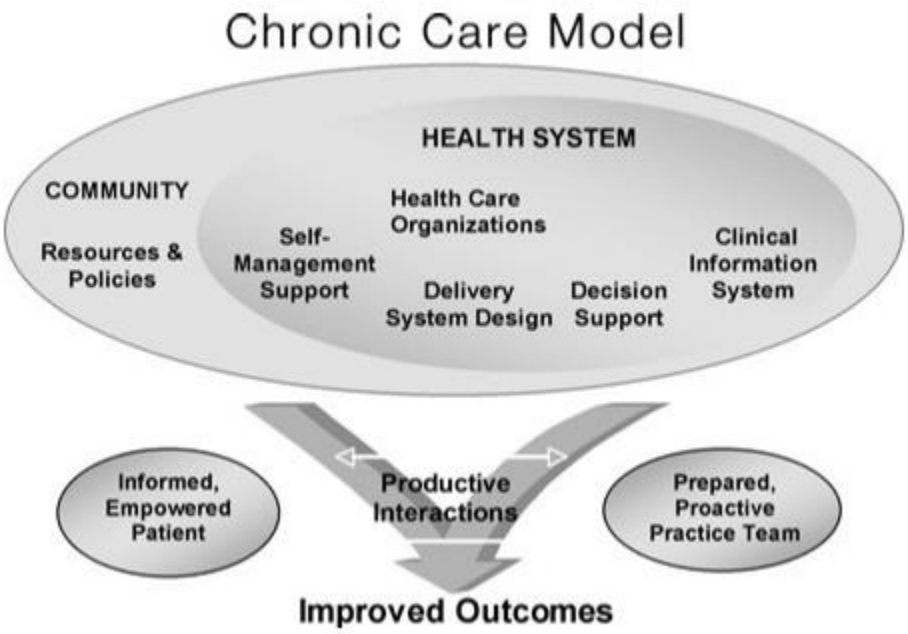
CBM- Cognitive Behavioral Model; **CC**- Coordination of care; **CCM**- Chronic Care Model; **CPM**- Communication-Persuasion Model; **CSS**- Cross Sectional Study; **DM**- Diabetes Mellitus; **HBM**- Health Belief Model; **PNM**- Patient Navigation Model; **PPSD**- Pre and post study design; **SCM**- Stages of Change Model; **SEM**- Social Ecological Model; **SM**- Self-management; **SR**- Systematic review; **Qual-** Qualitative studies

Findings										
Reduction in A1C				X	X		X		X	X
Improved SM			X	X	X		X	X	X	X
Improved knowledge of DM	X		X	X	X			X	X	X
Identified importance of CC		X				X	X			X

CBM- Cognitive Behavioral Model; **CC**- Coordination of care; **CCM**- Chronic Care Model; **CPM**- Communication-Persuasion Model; **CSS**- Cross Sectional Study; **DM**- Diabetes Mellitus; **HBM**- Health Belief Model; **PNM**- Patient Navigation Model; **PPSD**- Pre and post study design; **SCM**- Stages of Change Model; **SEM**- Social Ecological Model; **SM**- Self-management; **SR**- Systematic review; **Qual-** Qualitative studies

Appendix C

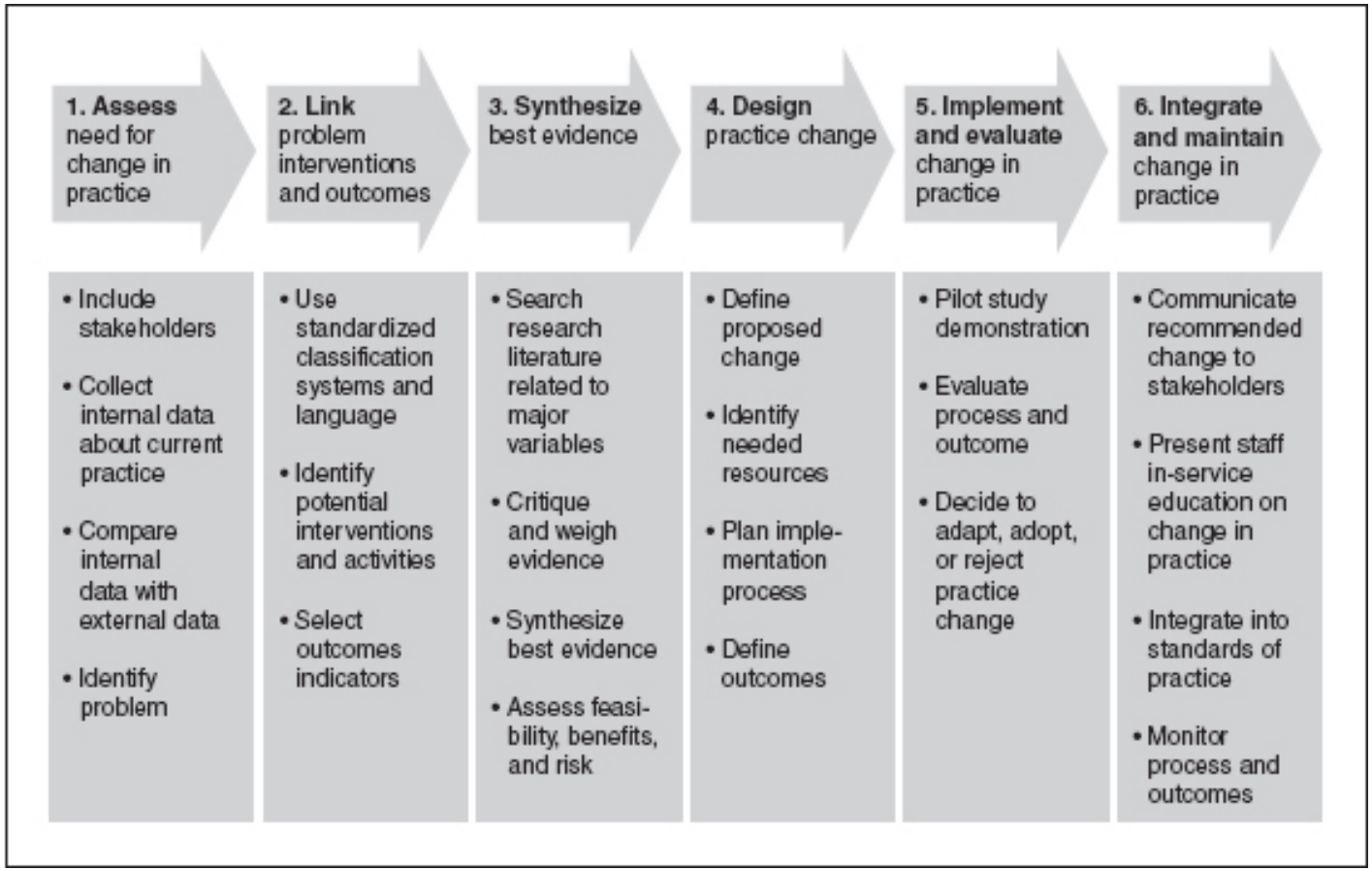
The Chronic Care Model



https://www.nap.edu/read/13272/chapter/12

Appendix D

Rosswurm and Larrabee's EBP Model for Change



Pipe, Teri Britt, et al. "Implementing evidence-based nursing practice." MedSurg Nursing, June 2005, p. 179+

Appendix E

Arizona State University Internal Review Board Approval Letter

APPROVAL: EXPEDITED REVIEW

Jonathan Helman
EDSON: DNP
602/475-0675

Jonathan.Helman@asu.edu Dear

Jonathan Helman:

On 10/1/2019 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Type 2 Diabetes Self-Management in the Rural Health Population
Investigator:	Jonathan Helman
IRB ID:	STUDY00010682
Category of review:	(7)(a) Behavioral research
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Recruitment script, Category: Recruitment Materials; • Prequestionnaire-LMC Skills, Confidence and preparedness Index (SCPI), Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • CitiTraining_Witthar, Category: Other (to reflect anything not captured above); • Witthar-Debra- IRB Form-Social-Behavioral-Protocol_2019 changes, Category: IRB Protocol; • NP owned project site letter of approval, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • DSME brochure 2, Category: Recruitment Materials; • DSME poster 2, Category: Recruitment Materials; • Implied Informed Consent, Category: Consent Form; • John Hancock letter of support, Category: Other (to

	reflect anything not captured above);

Appendix E (continued)

	• Postquestionnaire-LMC Skills, Confidence and preparedness Index (SCPI), Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • CitiTraining_Helman, Category: Other (to reflect anything not captured above); • Text Messages for Type 2 Diabetes Self-Management in the Rural Health Population, Category: Participant materials (specific directions for them);

The IRB approved the protocol from 10/1/2019 to 9/30/2020 inclusive. Three weeks before 9/30/2020 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 9/30/2020 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the “Documents” tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

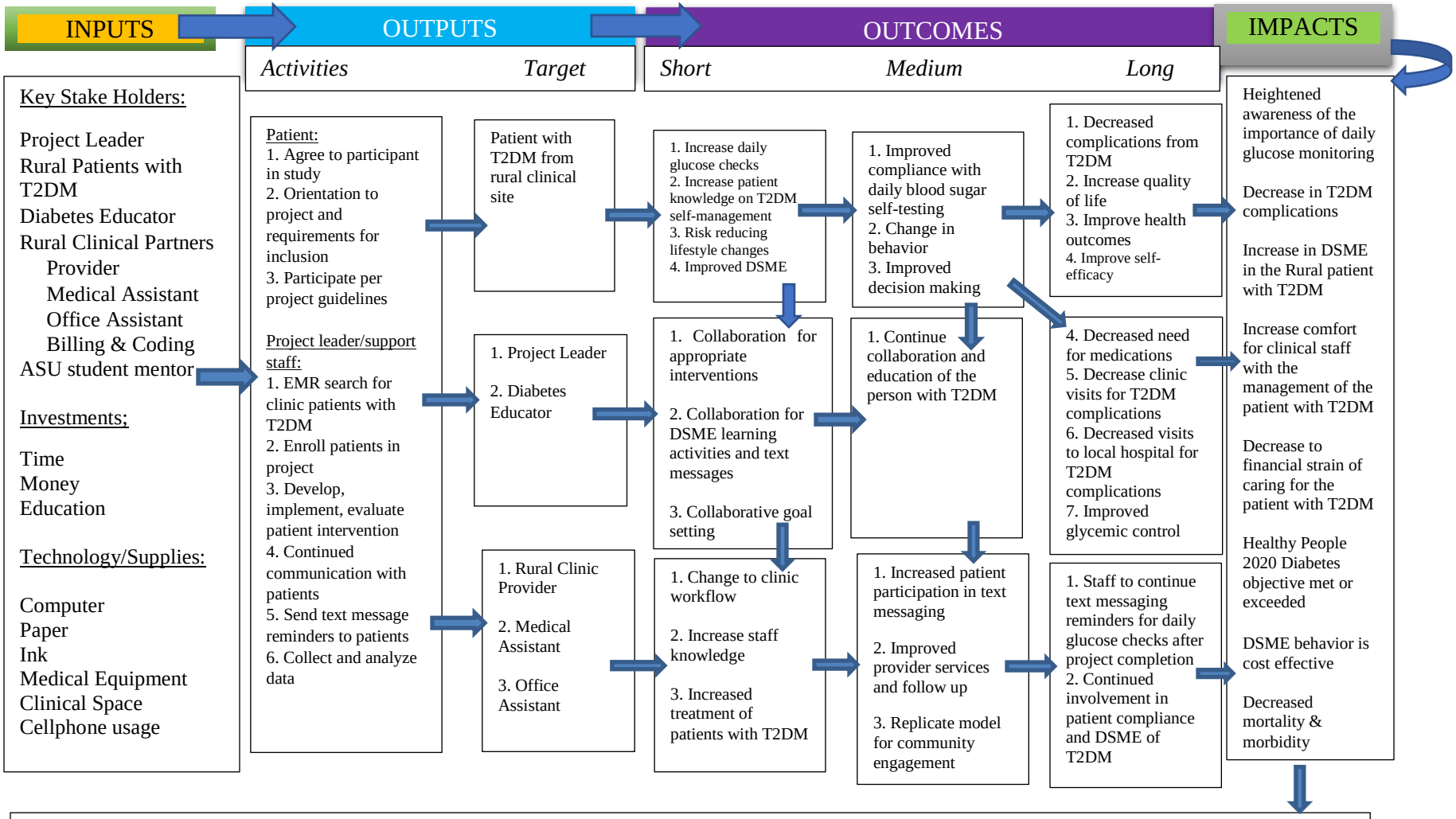
Sincerely,

IRB Administrator cc:

Debra Witthar
Jonathan Helman

Appendix F

Goals: *Improved diabetes self-management (DSME) and glycemic control for the T2DM rural health patient*



Assumptions: 1. Inclusion of all patients with T2DM from the clinic data base search. 2. Stronger relationship between rural provider and patient population. 3. Improved communication between patients and support staff. 4. Universally implement to include future patients with T2DM in the clinic. 5. Patient willingness to participate in project. 6. Literature review supports correlation between glucose monitoring and improved self-management of disease improving patient outcomes.

Appendix G

Text Messages for Type 2 Diabetes Self-Management in the Rural Health Population

1. What is Type 2 Diabetes? It is a disease of the metabolism that results from a lack of insulin production from the pancreas, cells that become resistant to insulin or both. Sugar (glucose) comes from the food we eat or from the liver that stores glucose. Sugar is found in the cells or the blood stream. Cells that block insulin do not allow sugar to enter the body's cells for use and storage. All this extra glucose is left in the blood stream and causes the blood to thicken. Glucose is poisonous to the nerves. When your sugar levels are high there can be damage to the nerves in areas of your body like the hands, feet and eyes. This is known as neuropathy. Uncontrolled blood sugar levels can cause damage to areas of the body which include the eyes, brain, kidneys, heart and blood vessels. Well controlled blood sugar decreases neuropathy, improves the mind, prevents infections, increases energy and calms emotions. The Arizona Diabetes Foundation web site https://arizonadiabetesfoundation.org can offer support and information on diabetes. "A diabetic *has* to do what everyone else *ought* to do!"

2. What is a hemoglobin A1C? A hemoglobin A1C is a 3 month average of your blood sugar levels. Your provider uses this number, and other factors, to adjust your medications. You should have your A1C checked every 6 months and every 3 months if you are having trouble controlling your sugars. Most people should aim to have an A1C 7.0% or less. Being sick, eating too much food, not being active, stress, too little diabetes meds and side effects of other meds, especially steroids, can make your sugar levels high. Signs of hyperglycemia (high blood sugar) include headache, increased thirst, increased urination, blurred vision, trouble concentrating, fatigue and weight loss. Not enough food, consuming alcohol, too much diabetes medications, excessive exercise and side effects of other meds can make your sugar low. Signs of hypoglycemia (low blood sugar) include dizziness, hunger, shakiness, irritability, seeing "spots", confusion and sweating. Be sure to always have glucose tabs, glucose gel or a snack on you always to increase your blood sugar if needed.

3. Checking your blood sugar is very important. You should keep a log of your blood sugars to take to your medical visits, so your provider knows how your sugar levels have been, so they can adjust your diabetes medications if needed. If you are taking pills to control your blood sugar, you should check your sugar once per day, before breakfast or before bedtime. If you are taking insulin, you should check your sugar before each meal and at bedtime. Follow the insulin dosing set by you and your provider. Do not take your quick acting insulin if you're not going to eat your meal in the next 15-30 minutes. If you take insulin without eating, your glucose can drop, and you will be hypoglycemic. If your glucose is consistently higher than 200, notify your provider.

Appendix G (Continued)

Fighting high sugar levels can make you feel upset, angry and even annoyed. Don't use the numbers to judge yourself. Following your numbers lets you and your provider know how well your diabetes plan is going. Talk with your provider about your feelings and fine-tune your plan as needed. It takes time to get your sugar levels just right. You are not alone in this struggle.

Log into the American Diabetes Association to create a free account. Here is the link for a free printable blood glucose log https://www.diabetes.org/diabetes/medication-management/blood-glucose-testing-and-control/checking-your-blood-glucose

4. Always carry your glucose monitor with you, you never know when you may need it. Be sure to check your glucose, as directed, by your provider. If you feel symptoms of high or low blood glucose, you may need to check your glucose more often. Be sure to get medical help when needed. What do the numbers mean? When you check your glucose before meals you can adjust your carbohydrate intake. Typically, if your glucose is greater than 180, you should eat less carbs. If your glucose is less than 80 you should eat more carbs. Checking your glucose before exercise is important to avoid low glucose. If your glucose is less than 150, you should eat a 15 gram carbohydrate prior to exercise. If it is greater than 250, you need to wait to exercise until your level drops. In cases of sickness, you may need to monitor your glucose more often. If your glucose is greater than 250, you may need to tell your provider. If your glucose is less than 80, and you are feeling signs of low blood sugar occurring (sweats, shakes, headache, dizziness, confusion), eat or drink 15 grams of carbohydrate. Rest and recheck your glucose in 20 minutes. If you are still low, eat or drink another 15 grams of carbohydrate and call your provider. In examples as mentioned above, you may need to adjust your medications. Call your provider for explanation and directions. If you are having difficulty understanding what the provider is telling you, don't be afraid, ask for an explanation. It is very important that you know how to manage your disease. Diabetes is complex and you need the time to understand that plan. "*You* control your diabetes, do not let *it* control you!"

5. Stress management is a vital part of glucose control. "Diabetes distress" is an emotional reaction to the burdens of living with diabetes. When you are stressed your body releases chemicals called cortisol and adrenaline. These chemicals cause an increase in your heart rate and blood pressure, as well as cause the liver to release stored glucose, which raises your blood sugar levels. Stress can even block the release of insulin from your pancreas. Long-term stress can be harmful to our stomach, causing ulcers, and our hearts, causing harm to the blood vessels. All this happens whether a person has diabetes or not. Try to find your stressors. You may feel tired, have muscle aches, headaches, be irritable, unmotivated, restless or depressed. If you are more stressed on certain days than others, try to walk, take a warm bath, listen to relaxing music to bring inner calm. If you notice stress is causing changes in your sugar levels,

Appendix G (Continued)

make a note of it so you can discuss these findings with your provider. Talk to a loved one or friends about your worries. Talk with your provider, there may be financial help for diabetes medications and glucose monitoring supplies, if this is a concern. There are online and in person support groups that can help. Start a support group of your own and meet other people that share the struggles and triumphs of diabetes. Gardening, painting, reading a book, walking, meditation, yoga, massage, essential oils and relaxation can be a great part of stress relief to bring calm into your life! The Centers for Disease Control has an excellent web site for diabetes distress and coping ideas at https://www.cdc.gov/diabetes/ndep/people-with-diabetes/ten-tips-coping-diabetes-distress.html

6. Move and grove to get your heart rate up at least 20 minutes per day. Movement can be done in a variety of ways-biking, walking, swimming, yoga, hike, Pilates and using weights or exercise bands just to name a few. Walk to the mail box, don't drive. It does not have to be hard and tiring exercise, every bit of movement counts. Can you believe you burn calories doing household chores such as sweeping, mopping, gardening, mowing the lawn and cooking? A great tip is to wear a medical alert bracelet as part of your workout wardrobe. It should show that you have diabetes and whether you take insulin. Also, keep a snack or glucose tablets with you while exercising, in case your blood glucose levels drop. Every change you make, no matter how small it may seem, makes a difference in your ability to manage diabetes. You will increase your cells sensitivity to insulin, increase bone thickness, improve the body's ability to burn fat, lower your glucose, cholesterol, stress levels, and blood pressure while strengthening muscles and bones. Moving daily improves your sleep. Even losing 10-15 pounds can have a huge impact on your health. The power to change is firmly in your hands—so let's get moving today.

7. The ABCs of diabetes. A is for A1C. Be sure to have this checked at least every 6 months. Every 3 months if you are struggling with glucose control. B is for blood pressure. Diabetes affects the blood vessels everywhere in the body. It is important to check your blood pressure at least once per month to make sure you are not experiencing hypertension (high blood pressure). Increased blood pressure can further damage the vessels in your body, especially in the eyes and kidneys. Most people should aim to keep their BP less than 140/90. C is for cholesterol. Package and pre-prepared foods (macaroni and cheese, chips, pasta, boxed foods, etc.) and fatty foods have high cholesterol contents. Increased levels of cholesterol can lead to blockage of the arteries, especially in the heart and kidneys. The target over all cholesterol should be below 200. The low density lipid (LDL), "bad" cholesterol, target is less than 100. The high density lipid (HDL), "good" cholesterol, target is greater than 45. It is important to eat a low fat diet and move regularly to keep your sugar, blood pressure and cholesterol under control. You may need to be placed on a "statin" medication, like

Appendix G (Continued)

pitavastatin or pravastatin, to correct high levels of cholesterol. Discuss this with your provider.

8. Eyes and feet need special care with diabetes. You should see an eye doctor once a year to check for diabetic retinopathy, even if you think your vision is fine. Diabetic retinopathy is a complication that occurs to the blood vessels of the eyes which can lead to blindness. The early stages of retinopathy can have no symptoms. Symptoms include blurred vision, changes in seeing colors, spots or dark strings floating in your vision, and loss of vision. It is also important to check your feet and between the toes daily, or at least every other day, for redness, bruising, blisters and cuts in the skin. If you cannot see all areas of your feet, use a mirror or have a loved one help you. People with diabetes often suffer from neuropathy and cannot feel sores spots on their feet caused by shoes or objects. Look in your shoes and at the soles of your shoes before you put them on to be sure there is nothing sharp stuck in your shoe, like a staple or tack. Diabetes cause you to heal slowly. You need to lower the risk of infection and problems from wounds. Avoid soft soled shoes or flip flops. Wear shoes that are supportive of your feet, like tennis shoes or sneakers. Keep your toenails trimmed and smooth, but not too short!

9. How does insulin work in your body? Insulin is made in an organ called the pancreas. One of the complications of Type 2 diabetes is the pancreas does not make enough insulin to meet the needs of the body. There are several types of insulin medications. We will discuss rapid acting and short acting today, sometimes called bolus insulins, and are used to cover the blood glucose elevation from eating. These medications may be taken along with a long acting insulin. It is important to know the difference between these medications and why you may need both a bolus insulin and a long acting insulin. (Your second text message this week will discuss the long acting insulins.) Rapid acting insulins, Humalog and Novolog, are injected up to 15 minutes before each meal because they are absorbed by the body almost immediately and begin working within 15 minutes. They are most effective 1-2 hours after injection and stop working in 4-6 hours. Short acting insulins, Humulin R and Novolin R, Regular insulin is not absorbed as quickly, so it is usually injected 30 minutes before each meal. It begins working in 30 minutes to an hour and is most effective 2-4 hours after injection. The effect wears off after 5-8 hours. When taking either medication you need to begin eating within 15-30 minutes of taking the medication. They last in your system just long enough until it is time for your next meal. This explains the need to check your glucose before meals and to take your insulin with every meal. If you skip a meal, do not take your insulin. If you take your insulin without eating it can cause you to become hypoglycemic. Be sure to rotate injections sites when taking insulin to prevent tissue damage and scarring. This is a quick and easy web site, Diabetes Daily, that shows you how your insulins work https://www.diabetesdaily.com/blog/2014/01/how-does-insulin-work-2/

Appendix G (Continued)

10. We previously discussed rapid acting and short acting insulin, now we will discuss long acting insulin. The two most common forms of long acting insulin are Lantus/Glargine and Levemir/Detemir. These medications do not peak, unlike the meal coverage insulins. They last 24 hours in your system and should be taken at the same time every day. These medications provide smooth, even coverage, all day long and are effective in controlling your overall glucose levels. As with all your diabetes medications, keeping a glucose log will help your provider adjust your medications if needed. If you miss a dose of your fast acting insulin (Humulin or lispro) it may be too late to take it because it will affect your next dosing scheduled. If you miss your long acting insulin (Lantus or Detemir) check your glucose level. Taking an additional dose can cause your glucose to drop too low. Be sure to alternate injections sites when taking insulin to prevent tissue injury and scarring. This is a quick and easy web site, Diabetes Daily, that shows you how your insulins work https://www.diabetesdaily.com/blog/2014/01/how-does-insulin-work-2/

11. How does metformin work in your body? Metformin is a pill taken once or twice per day. Metformin works in the body by lowering the amount of sugar produced in the liver and increasing the sensitivity of muscle cells to insulin. It can reduce your A1C by 1.5%-2.0%. The most common side effects of metformin include diarrhea, bloating, gas, constipation, stomach pain, heart burn and nausea. A very rare but serious side effect, the buildup of lactic acid in the body, can occur when the body does not clear metformin, such as in cases of kidney disease. Warning signs of lactic acid buildup include fast and shallow breathing, severe muscle aches and cramping, unusual weakness or tiredness, or feeling cold. While on metformin, your provider will monitor your kidney function. Be sure to notify your provider should you have any of these issues. Did you know metformin can even help with weight loss? If you miss a dose of your medication, take it as soon as you remember. Skip the missed dose if it is close to your next scheduled dose and do not double doses.

12. Balanced meals are important to the management of diabetes. The American Diabetes Association (ADA) has great tips on "What Can I Eat?" https://www.diabetes.org/blog/what-can-i-eat There are several different types of diets and lifestyles out there, so be sure to do your research. The lifestyles most beneficial for persons with diabetes are the Mediterranean, Vegan and Vegetarian diets. The ADA states these diets reduce the risk of diabetes, reduce A1C levels, reduce the risk of cardiac disease and promote weight loss. It can be difficult to stop your use of meats, milk, and cheese, but even reducing your intake of these items can provide important benefits. The Mediterranean lifestyle includes healthy foods like vegetables, fruits, fish, and whole grains, and fewer unhealthy fats. It also includes ingredients like olive oil, which when consumed in moderation, are good for lowering stress and increasing

Appendix G (Continued)

"good" cholesterol levels in the blood. Other features of the Mediterranean lifestyle include eating with family and friends, getting plenty of exercise, and eating your biggest meal of the day at lunch instead of dinner. According to the Mayo Clinic, studies have shown that eating Mediterranean food reduces the risk of heart disease, cancer, Parkinson's Disease, and Alzheimer's Disease. Women who stick to a Mediterranean diet menu supplemented by extra virgin olive oil and mixed nuts are at reduced risk of breast cancer. With access to millions of recipes on the internet, eating should never be boring or dull again! Mayo Clinic link to the Mediterranean diet https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/mediterranean-diet/art-20047801

13. When eating out and carb planning, there are certain things to consider. Most restaurants will used processed or canned foods that are high in fat, sugars and salt. Ask for the nutrition information of menu choices, if they are available. Chinese cuisine, American fast food and hamburger joints tend to be high in sugar, salt and fats. Try to choose restaurants that use fresh vegetables and meats. Thai, Indonesian, and Greek cooking tend to offer more flavorful and fresh options. A restaurant that serves a wonderful salad is always a possibility. Look at the "healthy options" on the menu. You can always ask for your food to be baked, broiled or grilled, rather than fried. See what whole grain choices may be available. You can ask for no butter, less/no oil and reduced cheese. When choosing a drink, keep in mind that any soda is bad. Studies have found that even reduced calorie soda can led to weight gain. Choose unsweetened iced tea or coffee, water with lemon or fruit in it, or mineral water. If you have never tried cucumbers in water, I invite you to do so, you will be amazed by the flavor!

14. Micronutrients are smaller nutrients our bodies need to maintain function. These included vitamins and minerals. Minerals play an important role in growth, bone health, fluid balance and several other processes. Meanwhile, vitamins are necessary for energy production, immune function, blood clotting and other functions. The Standard American Diet, or SAD diet, lacks micronutrients. Foods are now over processed and are stripped of their nutritional value. Think of how the grocery store is set up. The fresh fruits, veggies and meats are on the outer portion of the store and all the processed, canned and boxed foods are in the middle. You can see, we should be doing our shopping from the outer edges of the store, not in the middle. Our food plates should be a wonderful rainbow of colors, filled with fruits, veggies and lean meats, not bland with whites and yellows full of starches and sugars. Under Armor has an easy to use web site, MyFitnessPal, that explains micronutrients in detail. I invite you to visit the web site for tips and recipes. I even booked marked it for myself! https://blog.myfitnesspal.com/essential-guide-to-micronutrients/

Appendix G (Continued)

15. Carbohydrate counting is important to controlling your diabetes. There are 3 types of carbs; sugar, starches and fiber. Sugar can be found in fruits and added to cookies, cakes and processed foods. Starches are found in potatoes, beans and grains. These turn into sugar in our bodies. Fiber can be found in vegetables and fruits, plant type foods. Fiber in fresh plant based foods binds to the sugar and helps to eliminate it from the body. Insoluble fiber does not digest and cleans your intestines, like a natural scrub brush, as it passes through. Insoluble fiber is the stringy part on celery for example. Eating foods higher in fiber can help your digestion, lower your blood sugar, and reduce your risk of heart disease. You and your provider will discuss the carb count that is most beneficial to meet your caloric needs. Read the labels on food to determine what the carb count would be. Typical carb counts range from 30-60 carbs per meal. There are a lot of great Apps out there to help you track carbs and meal planning. Most are free and provide valued information. The ADA web site has valuable information on carbohydrates https://www.diabetes.org/nutrition/understanding-carbs/get-to-know-carbs

16. Have you heard of mindful eating? Mindful eating helps to control your eating habits using your 5 senses (vision, hearing, taste, smell, and touch). It promotes weight loss, reduce overeating, and helps you feel better. Mindful eating includes eating slowly and without interruption, being able to listen to physical hunger cues and eating only until you're full, involving your senses by noticing colors, smells, sounds, textures, and flavors of your food. We tend to overeat when we are distracted by watching TV or surfing the internet. Eat a meal without these interruptions. Chew your food slowly and take the time to taste all the different flavors. Eating to maintain overall health and well-being and appreciating your food are benefits to mindful eating. The food on our plates should be colorful and bring us joy. Mindful eating information can be found at Healthline https://www.healthline.com/nutrition/mindful-eating-guide

17. We will be having a "Project Completion Party" at the clinic office on January 10, 2020 from 2pm to 4 pm. I want to show my thankfulness for you all. I will provide drinks (some of that delicious cucumber water to try) and light snacks. You will have the chance to complete your final survey in the office if you prefer. I will be available to answer any questions you may have on diabetes or the project. This is our chance to interact and mingle while eating delicious, nutritious foods. I will be making recipes from the Under Amour site mentioned in our previous text messages. The cucumber tomato salad looks delicious and will awaken that mindful eating. I invite you to return the web site for tips and recipes. https://blog.myfitnesspal.com/essential-guide-to-micronutrients/

Thank you and hope to see January 10th!

Appendix H

Budget- Diabetes Self-Management Project, text messaging

Phase	Activities	Cost	Subtotal	Total
Preparation	Design and print -project description handouts and posters for office (50) -consent forms -pre/post evaluation tools (23) -pens (23)	$100		
	MA and Office Assistance time (8 hrs x $16/hr)	$128		
	Design and develop text messages (10 hrs x $40/hr)	$400	**$628**	
Delivery	Text message data fees ($0.05 x 18 text total x 23 participants)	$20		
	MA and Office Assistance time fielding questions, if needed (4 hrs x $16/hr)	$64	**$84**	
Evaluation	MA and Office Assistance time for possible follow up, if needed (8 hrs x $16/hr)	$250		
	Intellectus Statistical software	$65		
	Review and analysis of results (40hrs x $40/hr)	$1600	**$1915**	**$2,627**

Appendix I

Skills, Confidence, Preparedness Index (SCPI) tool

LMC Diabetes Skills, Confidence & Preparedness Index (SCPI)

Answer the following questions on a scale of 1-10 (1= very little and 10= a lot) . Please do this by drawing a line on the scale where you see yourself for each question.

1. I am able to portion out and choose foods that have the optimal balance between carbohydrates, proteins and vegetables to help keep my blood sugars in target.

1 (very little) 10 (a lot)

2. I know how my diabetes insulin or medication works in my body and at which time of day I should check my blood sugars to make sure my dose is correct.

1(very little) 10 (a lot)

3. I feel confident that I can plan balanced meals and snacks effectively.

1 (very little) 10 (a lot)

4. If I miss a dose of my insulin or medication, I know how my body will react and the steps to take to get back on track.

1 (very little) 10 (a lot)

5. When I am planning to exercise, I know what changes I need to make to avoid a low blood sugar before, during, and after exercise.

1 (very little) 10 (a lot)

6. I am confident that I can implement stress management techniques into my lifestyle.

1 (very little) 10 (a lot)

7. I know when to check my blood sugar if I want to see how my body reacted to a meal.

1 (very little) 10 (a lot)

8. When I am sick, I know what to do differently with my medication intake, blood sugar testing, and when to go to the hospital.

ns, fluid intake, food

1 (very little) 10 (a lot)

9. I intend to start planning and eating balanced meals and snacks starting next week.

1 (very little) 10 (a lot)

10. I know how to identify stress in my life and how it can impact my diabetes management & overall health.

1 (very little) 10 (a lot)

11. I'm confident that I can plan ahead for what to do, and how to react, either before, during or after exercise to avoid a low blood sugar.

1 (very little) 10 (a lot)

12. When I look at my blood sugars in my meter or in my logbook in a given week, I could explain to my diabetes educator or doctor what my blood sugar pattern is.

1 (very little) 10 (a lot)

13. I plan to choose an activity and begin incorporating it into my schedule in the coming week.

1 (very little) 10 (a lot)

Appendix I (continued)

14. I am confident that at the next time I am eating out of my home, I will be able to plan and

_____

1 (very little) 10 (a lot)

15. I plan to start using my blood sugar levels to make changes to my diet and/or insulin

_____

1 (very little) 10 (a lot)

16. I am confident that I can choose a healthy activity for me and include it into my schedule.

_____

1 (very little) 10 (a lot)

17. I plan to start making a list of stress management techniques which will work for me in the

_____

1 (very little) 10 (a lot)

18. I am confident that I can adjust my insulin or medication doses, on my own, to reach the

_____

1 (very little) 10 (a lot)

19. I am confident that I can commit to preventing and monitoring my diabetes complications such as seeing my eye doctor at least once a year and checking my feet on a daily basis.

_____

1 (very little) 10 (a lot)

20. I plan to start adjusting my insulin or medication doses on my own starting next week.

_____

1 (very little) 10 (a lot)

21. I am confident that I will use my blood sugar results to make changes to my diet and/or

_____

1 (very little) 10 (a lot)

22. I know what the ABCs (Al e, Blood Pressure, and Cholesterol) of Diabetes are, what my

_____

1 (very little) 10 (a lot)

23. I plan to start looking for patterns in my meter or logbook starting next week.

_____

1 (very little) 10 (a lot)

24. The next time I am sick, I will make the necessary changes to my medications, insulin and/or

_____

1 (very little) 10 (a lot)

25. With my next exercise, I am going to make a plan to reduce the chance of a low blood sugar,

_____

1 (very little) 10 (a lot)